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ROOT-KNOT.

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ROOT-KNOT, or crown-gall, has been familiar to orchardists for the past half-century, and perhaps longer. It was originally looked upon as a mere malformation due to some special conditions to which the affected plants were subjected. In the United States, however, the affection was considered a disease, owing to the unthrifty appearance and ultimate death of numbers of trees on which galls were developed on the roots. Peaches appeared to be the worst sufferers, and some thirty-odd years ago Professor Toumey carried out a series of investigations on the etiology of the disease. He appeared to prove fairly conclusively that the causal agency in the production of root-knot was one of the slime fungi, a group of lowly organisms one member of which is the cause of that destructive disease club-root, so common amongst the Brassica family.

For many years Toumey's contention that a slime fungus, to which he gave the name *Dendrophagus globosus*, was the causal agency of root-knot was fully accepted by the majority of plant pathologists, with the exception of those of Europe, who still held that the condition was due to conditions of a non-parasitic origin. In 1906, however, on the publication of Dr. Erwin F. Smith's preliminary investigations, root-knot was shown to be of bacterial origin, and the organism that had for two decades been generally assumed to be the cause was relegated to a position of harmless insignificance. Since 1906 the further work of Dr. Smith and his associates has apparently put beyond all doubt that root-knot is a true bacterial disease, and the name *Bacterium tumiefaciens* has been given to the causative organism.

GENERAL APPEARANCE.

The condition known as root-knot is characterized by the production of convoluted swellings of various sizes on the roots of many plants. On apple-trees the galls occur most frequently at the junction of a graft, and they are especially common on root-grafted nursery stock. The swellings vary in size from an inch or so in diameter to as large as a man's closed fist. At times the bark covering the gall is quite smooth, but generally the exterior is roughened and knobby. Two types of galls, soft and hard, appear to be formed. The soft type is generally quite white, and may after a certain length of time rot away; but, so far as my experience goes, it often appears to develop into the hard type of gall.

Until quite recently it was argued by nurserymen that these galls, irrespective of their size, represented when developed on apple-roots normal callus development, intensified at times perhaps by careless grafting exposing a certain amount of cut tissue, and that this callusing-over formed the knot. This view is no longer held by the majority of nurserymen, but it is a contention that even yet lingers amongst certain of our most practical members of the nursery trade. So far as apple-trees are concerned, the effect of root-knot is an extremely disputed point, many considering it to be perfectly harmless, while others are equally emphatic with regard to its dangerous nature.

DISTRIBUTION.

Root-knot has been recorded on nearly all our species of economic fruit-trees, and appears to be especially prevalent on peaches and apples. It is now considered to be virtually world-

wide in its distribution, and although by some it is thought to have been disseminated from China, the latest investigations seem to indicate that the causative organism is native to many soils, a contention that does not appear to be at all unreasonable.

The first published account of its presence in New Zealand is given by Mr. W. A. Boucher in the Department's annual report for 1900, and relates to a peach-orchard in the Whangarei district. The peach-trees were very severely affected, and the orchard was finally almost completely destroyed, presumably through the effects of the disease. It was contended that the disease owed its origin here to the importation of peach-pits from California, but there is no evidence that the disease can be spread from place to place in this manner. In the 1901 annual report Mr. J. C. Blackmore writes as follows: "A great number of peach-trees have been specially examined in the southern districts, but root-knot has not been observed. Tens of thousands of stocks were raised and transplanted from pits imported through the same agency and from the same place in California as those raised in Auckland. Various forms of root-knot I have, however, occasionally met with on and off for years on the apple, pear, plum, and cherry, also the raspberry. Root-gall is much more prevalent than is generally supposed, but often passes unnoticed."

During the past thirteen years I have each year seen specimens of young trees, mainly apples, on which were galls exactly similar to those described by American investigators as root-knot. In nearly every case these trees consisted of young nursery stock, and were submitted by planters who were anxious to know whether the exceedingly ugly growths on the roots were likely to prove injurious. In comparatively few instances have I seen root-knot *in situ* in established orchards, except in the case of those planted with the Northern Spy apple, where in many instances large knots protruding from the base of the stems near the ground are conspicuous.

AUSTRALIAN NURSERY STOCK AND A CURRENT INVESTIGATION.

The great extension of orchard planting in New Zealand has led to very large annual importations of fruit-trees, mainly apples, from Australia, the States of Victoria and Tasmania being our largest suppliers in this respect. From time to time consignments containing trees having the roots badly galled, often with swellings of very large size, have been shipped, and on arrival here have been condemned for root-knot, which is a scheduled disease under the Orchard and Garden Diseases Act. It has been contended, however, by the Victorian Department of Agriculture that no root-

knot exists in the nurseries of that State, and recently a hurried bacteriological examination of certain Victorian material has been undertaken, in co-operation, by Professor S. T. Champtaloup, of Otago University, Mr. C. C. Brittlebank, Plant Pathologist of the Victorian Department of Agriculture, and the writer. The results of this investigation are not yet completed, but an organism culturally and microscopically identical with that described by Dr. Smith under the name of *Bacterium tumiefaciens* has been isolated. Pure cultures of this organism, however, have as yet failed to produce positive results in inoculation experiments, and there is still a doubt whether in this case the organism is really the cause of root-knot. However, it must be remembered that the material used was all from a single culture from a single tree, and Dr. Smith himself repeatedly isolated the organism *Bacterium tumiefaciens* from apple material only to find that it gave negative results in inoculation experiments. It is also to be borne in mind that, owing to certain difficulties, the plants used for inoculation purposes in the recent examination were not apple-trees, but other soft-wooded plants which in American experience gave positive results. It is quite conceivable that the organisms isolated here may be pathogenic only to apple-trees, and this matter is now under investigation. Thus, although it cannot as yet be definitely said that the causal organism has been isolated, much more work remains to be done with cultures drawn from various sources, and inoculation experiments conducted under various conditions, before it can be in any way asserted that no pathogenic organism occurs in the root-knots of Australian apple-trees.

BRINGING IN WATTLE-BARK AT TE KAUWHATA.

CLOVER-GROWING FOR SEED.

POINTS BY A CANTERBURY GROWER.

LEVI LOWE, J.P., Rolleston.

ON the subject of clover-growing there are and always will be many differences of opinion. Consideration has also to be given to climatic influences and physical and chemical variations in soil—whether favourable or otherwise to the growing of clover—all of which require a certain amount of attention from the grower. These notes will therefore apply mainly to the class of land I have had experience of in Canterbury.

It is by no means the heaviest soil that grows the best clover-seed—I refer principally to white clover. The best average results I know of were obtained on good medium land with a good loamy subsoil. The seed matures better, and the sample is generally far superior to that growing on wet land. There are many ideal spots in Canterbury and North Otago (the Oamaru district) where white-clover-growing would return a handsome profit. Thousands of pounds have probably been lost to farmers in the Oamaru district alone through neglect to look after their white-clover crops.

PREPARATION OF THE LAND AND SOWING.

Pasture is often regarded as a last resource for land that is thoroughly exhausted and will not grow anything else profitably. It is also frequently assumed that grass and clover will grow anywhere and anyhow, and farmers are often surprised that the result of their labour is not profitable. The fact is that no farm crop requires more care in laying down than clover, and land that is not in good heart, and thoroughly cultivated and pulverized, often means failure of the crop. White clover, being a very small seed, requires the land to be very finely worked. After working down the soil I always roll with a heavy Cambridge roller, then sow the seed, harrow with light tine harrows, and roll again. By following these methods I have never experienced a failure.

My usual practice is to sow in February or at the beginning of March for autumn sowing, and in August and September for spring sowing. If the indications are for a wet autumn and winter,

I generally leave the second rolling till the spring, as the roughened surface helps to shelter the young plants, and the rolling in the spring will not do any harm. In regard to quantity of seed and mixture, I usually sow about 6 lb. of white clover, 3 lb. of red clover, and about a bushel of perennial rye-grass. This combination I have found the best, because if the crop is a failure for seed a return is obtained in grazing to set against the outlay.

As regards fertilizers, this depends principally on the condition of the soil at time of sowing. If the land is in good heart I do not generally sow manure, but I often give a top-dressing of fertilizer to a crop that has been laid down a couple of years. The chief manures I use are either Lawes superphosphate or a manure containing a good percentage of potash — about 2 cwt. to the acre, applied broadcast, and chain-harrowed in the latter part of winter or the early part of spring. A dressing of fertilizer is beneficial also after a heavy crop of clover-seed has been taken off the land. Basic slag seems utterly useless as a manure for white clover.

GRAZING.—CLOSING FOR SEED.—SORREL.

Many farmers graze off their young clover too soon, before the roots get properly established. I generally leave mine four months, and even then stock it lightly if it is required for seed purposes.

I find the best time to close off is about October, although one year I had two sacks of seed to the acre when the crop was closed on the 16th December, but that was in an exceptionally favourable season. For the treatment of old white-clover land extensively grazed I run the grass-mower over the paddock to level any tufts, and give it a stroke of the tine harrows and one stroke with the chain harrows early in the season, if possible before a shower of rain. This causes the plants to grow more vigorously.

Sorrel, which is a nuisance in white clover, is easily overcome if taken at the right time. This is as soon as the sorrel flowers, which is about a week or a fortnight before the clover flowers, with the exception of a few blossoms. My method is to get a big No. 4 McCormick mower, set the back part of the cutter-bar down and the fingers on the upward grade, and use a blunt knife, and then run the machine over the paddock. By this means the sorrel bloom is destroyed without damaging the clover, which will smother the sorrel before it can recover. Care must be taken, however, not to cut too deep into the clover. Farmers who have asked for a remedy for sorrel and tried my method have found it a success every time.

FERTILIZATION.

The fertilization of clover is a thing that is often overlooked, especially with white clover, which requires insect life to transmit the pollen just as much as red clover or cow-grass. A good plan is to place a few hives of bees in the paddock which is being kept for white-clover seed; the result will be found well worth the trouble. I once had a 10-acre lot of white clover, and put two hives in it in a sheltered position. When the paddock was reaped I divided it into two 5-acre lots and stacked the crop separately. The division next the hives yielded two more sacks of seed than the other, although it was thinnest in the plant. The conclusion from this result is easy to form. Cold, high winds are bad for clover during the fertilizing-period. I have seen during a strong east wind the pollen rising in thin grey clouds like smoke, the after-result being three-quarters of the heads blank. Fortunately, the conditions are rarely as bad as that.

HARVESTING.

Knowledge of the ripening process is of considerable importance to the novice. I have often seen good crops spoiled for want of knowing when to cut. If the crop is grown on the lines indicated it should ripen uniformly. I generally leave my clover till the heads are nut-brown and the stems free from sap, but when the crop gets to that stage it requires careful watching.

After having tried nearly every machine on the market for harvesting, I find an ordinary hay-mower with two seats the best. To this I attach a small home-made platform with a pivoted wheel to take the weight behind. The clover accumulates on the platform, and is pushed off sideways at the necessary intervals. In this way the clover-heads always stand upwards in the heaps, and thus the heaps should never be turned. This machine will cut clover even if the stems are only 2 in. or 3 in. high.

It is preferable to reap clover before rain than before a north-wester. The shower will do the crop no harm, but the nor'wester may. Turning the cut clover during wet weather should be avoided. I never turn, no matter how wet it is; but as soon as the weather takes up for fine lift the seed with a clover-fork on to a dry place. This is more satisfactory, and the crop less liable to scatter about with the wind.

If the weather is moderately good the clover should be left in the fields as long as ever it safely can be. This increases the ease of threshing, and seldom does the seed any harm. Wet weather before cutting is more injurious to the seed than wet weather

after cutting, if the seed is properly ripe. Early stacking is very injurious.

The most economical stack for shelling and keeping dry is the narrow form. I never build mine more than 9 ft. wide and as long again; the higher the better, within reason, as it means less trouble at the finish.

THRESHING AND CLEANING.

There are several clover-shelling machines on the market, but after trying several I prefer the English make with a Hunt rubber.

Never use perforated-zinc riddles for white-clover dressing if wire-cloth ones can be procured.

CONCLUSION.

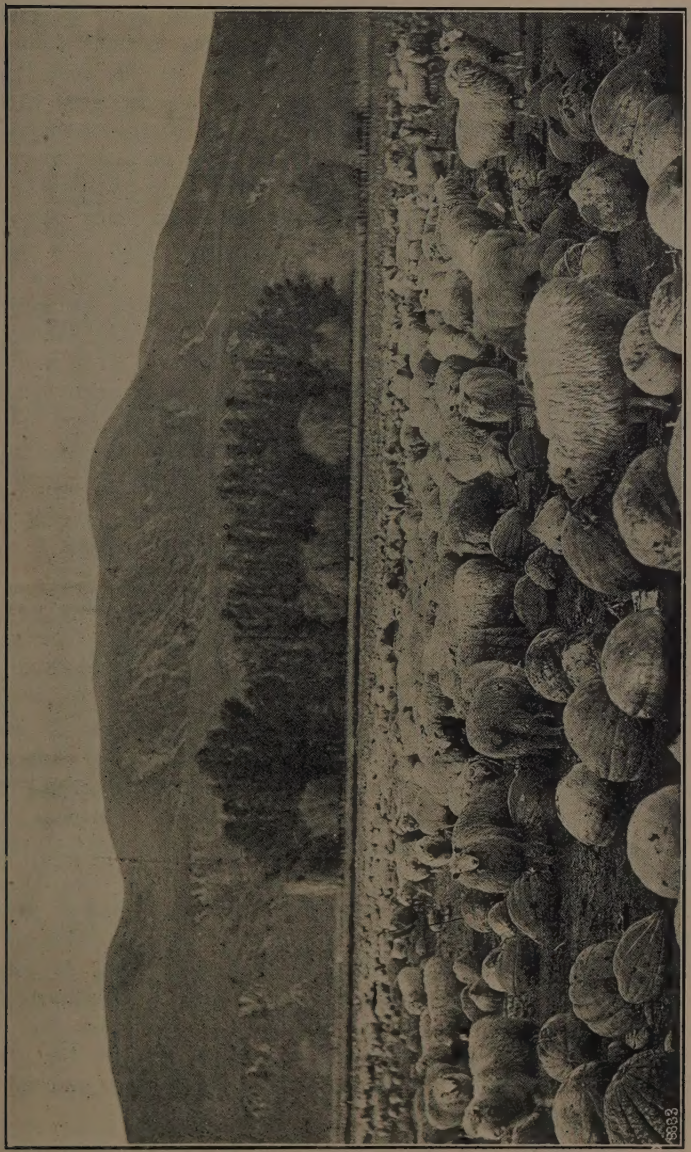
Most points of use to the inexperienced grower have been touched upon above, but there is much other interesting matter concerning clover and its culture. I have here kept principally to white clover because it is the easiest and most profitable crop for the novice. My opinion is that clover-growing for seed for the next few years will be a very profitable enterprise for the farmers who take it up.

PUMPKIN-GROWING FOR SHEEP.

A. J. FAULKNER, Wairakaia, Gisborne.

THE writer's experience in growing pumpkins for sheep-feed has proved so satisfactory that a few notes regarding methods of culture, &c., may be of use to *Journal* readers. The advantages of pumpkin-growing, I have found, are the small cost of the crop, the practical certainty (in the Poverty Bay district at least) of a fair to good yield, and, in my own case, the opportunity the crop affords for shutting up for a couple of months the hill country on which it is intended to winter hoggets, thus giving any cattle I may have in the paddocks a better chance. It also gives the grass a spell, and leaves clean paddocks with sweet feed for the hoggets to go on to.

My practice is to plough the land before the middle of August, if possible, and in September to work it down fairly fine, with



SHEEP ON PUMPKINS, WAIRAKAIA, GISBORNE.

the idea of giving any weeds a chance to germinate, then about once a fortnight putting the tine harrow or cultivator over the paddock to destroy any weeds. Sowing is done from the middle to the end of October. I have tried various machines, but do not find them satisfactory. Sowing on the flat in rows 16 ft. to 18 ft. apart and in clumps of three seeds a yard apart in the row can be recommended. A man with a single-furrow plough can line out rows 16 ft. to 18 ft. apart at the rate of about 16 acres a day, and four men or boys can sow (if they keep going) 16 acres per day, using 4 lb. to 6 lb. of seed per acre. In lining out rows we try not to have the plough-furrow more than 2 in. deep. Transplanting for gaps is not necessary: it is better to fill in with fresh seed. In my case the crop is intercultivated twice with either single, double, or three-horse cultivator, the only hand-work being in the row between and round the plants. If manure is required, guano has given good results, putting a small handful with each clump of three seeds.

The pumpkins grown are known in this district as ordinary sheep and cattle pumpkins, and by saving one's own seed from the strongest strains — those showing the best keeping and feeding-value properties — the improvement in future crops is very noticeable.

When the sheep are first put on to the pumpkins they eat all half-ripe and soft-skinned ones. After about a week's time it is necessary to commence splitting the harder pumpkins. Splitting for 1,500 sheep takes about an hour a day.

The area of the paddock shown in the photograph is 17 acres, and besides the pumpkin crop it contained a 13-ton stack of lucerne hay, to which the sheep had free access. Fifteen hundred ewe hoggets were put in on the 14th June, and were run five days on pumpkins and one day on grass until the 15th August—a total of fifty days and twelve days respectively.

Hay is very necessary for sheep on pumpkins, and I myself prefer to let them have access at will to a stack. This saves cost of carting, and there is really not a great deal of waste. In the present case, when the stack got well undermined and started to rock, we put a wire cable on to one corner, tied the cable to a dray drawn by three horses and screwed the stack half round. This made the stack settle down firmly, and in no way damaged the thatching.

The photograph was taken after the sheep had been on the pumpkins for a considerable time, when all leaves and foliage had been pretty well trampled down.

CALF-MANAGEMENT.

H. MUNRO, Inspector of Stock, Wellington.

SOUND judgment in feeding, scrupulous cleanliness, and shelter are the three essentials to success in the rearing of calves under artificial conditions. The farmers who are successful in such work can be divided into two classes, the first composed of those who realize that in so far as they depart from the animal's natural conditions of existence they must substitute others as similar in every way as possible, and the second formed of those who follow the management of the first without realizing the reason of its success.

The calf should be left with its mother until she has cleaned it, or any time up to twenty-four hours. It should then be removed to a clean sheltered place, such place, if a building, being provided with clean dry bedding. A large number of young calves up to a month old are lost annually as a result of septic material being introduced into the system through the navel when they are confined in insanitary sheds or dirty small enclosures. The symptoms of trouble due to this cause are scour, swollen joints, and depressed and feverish conditions. While the application of tincture of iodine to the navel immediately after birth will assist to guard against infection, the proper and safest method of prevention is to avoid the cause. Buildings used for housing calves should have good ventilation, impervious floors provided with good drainage, and should be regularly cleaned and disinfected. The practice of confining calves in old stables, fowlhouses, piggeries, or dirty small pasture enclosures cannot be too strongly condemned, and is bound sooner or later to end in trouble and loss to those who practise it.

The best method of teaching a calf to drink is by giving it the finger to suck in the pail of milk, and the safest method of feeding calves at any age is from the pail. In the opinion of the writer all mechanical feeders are more or less unsatisfactory, owing to the difficulty of keeping them in the clean condition so necessary to the health of the calf.

The milk or "beestings" produced by the mother during the first few days contains a material known as "colostrum," which possesses medicinal properties that are absolutely essential to the

normal development of the digestive system of the young calf, and during the first five days of its existence no milk other than this should be fed to it. Calves reared in the natural way, sucking their mothers, take their nourishment in small quantities at short intervals and at body heat (from 100° to 102° F.), and this fact is a sure guide to the proper method of hand feeding. The fourth stomach contains the acid juices (rennet), which possess the property of coagulating or curdling the milk, which is a necessary factor in the first process of digestion. Hence, if the quantity of milk given at any one time is sufficient to produce more curd than the weak digestion of the young animal can dispose of, an irritation may be set up in the stomach, followed by scour, and possibly death, from acute indigestion. It follows that, in order to avoid digestive troubles and get the best results from the food supplied, hand-reared calves must be given moderate quantities in a fresh condition and at a temperature which may vary between 85° and 102° F., at stated times daily, which should be as frequently as circumstances will permit.

When a large number of calves are being reared it is best to divide them into three lots for convenience in feeding, the first lot being those up to three weeks old, which should be fed at least three times daily, the second those up to ten weeks old, which should be fed at least twice daily and have access to a good range of suitable pasture and good water, and the third those up to weaners, which should have similar treatment to the second, excepting that the milk or whey should be fed in diminishing quantities as they approach weaning-time.

No hard-and-fast rule can be followed regarding the quantity of food which should be fed to calves at their different stages of growth, as some require and can digest and assimilate greater quantities than others of a similar age. For this reason one person should attend to the feeding regularly, as by doing so the feeder becomes conversant with the peculiarities of each animal, and can more readily detect sickness and guard against the overfeeding, which is one cause of sickness and mortality. The best method of feeding is the bail system, as it guards to some extent against the habit of sucking ears, and the feeder can efficiently control the quantity taken by each calf. The bails should be provided with a roof and concrete floor, but, if not, they should be so constructed as to permit of easy removal to clean ground when desired.

Scouring in calves is the common result of indigestion, and in calves up to weaning-age this is attributable to causes such as

failure to feed the beestings to new-born calves, confining them in insanitary buildings or dirty pasture enclosures, overfeeding (which is to a great extent the result of not feeding sufficiently often), sudden complete changes of diet, the use of dirty utensils for storing milk or whey and feeding the calves, feeding unsuitable artificial foods or overfeeding with artificial foods that would be suitable in proper quantities, feeding any food which has been permitted to ferment, or feeding any food at an unsuitable temperature. The prevention of indigestion and scouring naturally consists of guarding against the causes, but the addition of lime-water or carbonate of soda (baking-soda) to the food, in the proportion of a cupful of the former or a teaspoonful of the latter to the milk of every five calves, will also be found very beneficial.

Calves require whole milk until they are at least two weeks old, and, as all sudden complete changes of diet are injurious, the method of changing from whole milk to skim or whey should be by substituting daily a pint of the latter, in conjunction with a minimum ration of artificial food, for a pint of the former, at the same time gradually increasing the ration of artificial food so as to reach the maximum ration when the calf is seven or eight weeks old. The quantity of artificial food which it is desirable to feed to calves at the different periods of their age will depend on the food material used and the varying quantities which the different animals can profitably utilize, but the maximum ration of any food which could be safely consumed and profitably utilized by a calf seven or eight weeks old would be injurious and likely to cause indigestion and scour in a calf two or three weeks old.

The materials commonly used as substitutes for the ingredients taken from the milk for commercial purposes are pure linseed, oatmeal, ground maize, and pollard. Linseed is one of the most valuable of these, as the oil it contains, besides being of great nutritive value, promotes a healthy condition of the organs of digestion, and for this reason it should form part of all mixed foods. It is also particularly valuable for feeding pure in the form of linseed-jelly in small rations when starting young calves on artificial foods. The proportions for this purpose are 1 lb. of seed to 1 gallon of water, and the jelly is made either by boiling the seed until the capsules burst and a jelly forms, or by pouring the boiling water on the seed and allowing it to stand overnight. A small tablespoonful of the jelly should be given in the milk to young calves, and the quantity gradually increased so that

half a pint will be fed when the calf is about seven weeks old. I have found it a good practice to feed nothing but pure linseed to calves up to four weeks old, after which other materials may be added. The proportions and conditions in which the various substitutes should be used have been dealt with in detail in previous issues of the *Journal*.

When a calf is living almost wholly on milk diet—that is, up to two or three weeks old—the whole work of digestion is carried out by the fourth stomach, but the first, second, and third stomachs take up their proper functions of preparing the food for digestion in the fourth stomach immediately the animal commences to graze. From this time on the calf should have access to good clean pasture, both in order to provide for the normal development of the stomachs and to secure their natural nourishment. While concentrated foods used in moderation are of great value for feeding to calves as substitutes for the ingredients taken from the milk for commercial purposes, or as adjuncts to pasture, it will be detrimental to the future welfare of the animals to feed such foods in excessive quantities, or to look upon them as satisfactory substitutes for bulky natural food, such as grass, which is so necessary to the proper development of the organs of digestion in the young ruminant. In order to secure the maximum degree of quality in any animal at maturity the growth from birth must be steady and uniform in the production of bone and muscle and in barrel-development. The excessive use of highly concentrated food will cause calves to lay on body fat at the expense of bone, muscle, and barrel-development, with the result that though calves so treated may make good vealers or mature into good cattle if nursed through the first winter, they are likely to become "wasters" if thrown wholly on their own resources after weaning, even under moderately good conditions. Graziers who regularly purchase dairy weaners for stocking high country come to realize this fact, and give preference to clean, moderately grown calves with good bone and barrel-development rather than to the heavier, fleshy calves with light barrels, although the latter class are at first sight more pleasing to the eye.

A good range of succulent pasture is necessary to the health and normal growth of calves, and the bad practice which is followed on many farms of utilizing the same small enclosure annually as a calf-paddock is responsible for a great deal of disease and mortality. Such enclosures, besides being calf-sick, are often foul with excrement of other animals, such as pigs, poultry, &c., and are quite unfit for the purpose for which they are used.

The suitability or otherwise of the pasture and water to which calves and young cattle up to two years old have access has a very strong bearing on their health and development. Certain classes of pasture which may be suitable enough for grown cattle will cause indigestion and scour in young cattle. Young grass is the ideal pasture for young calves, or, failing this, vigorous pasture at the stage of growth at which it would be considered first-class sheep-feed; whereas pasture which is coarse, sour, or more or less exhausted or stale from any cause is unsuitable and dangerous to any young cattle up to at least two years old.

Irritation of the skin, to which hand-reared calves are very subject, and which may be due to such causes as lice or disorder of the blood, will appreciably retard the development of affected animals unless promptly remedied. When lice are the cause the only remedy necessary is to apply two dressings of non-poisonous sheep-dip in the proportion of 1 part dip to 80 parts of water, the second dressing to be applied ten days after the first. This can be applied with a brush or rag, or by immersion in the ordinary plunge-dip used for sheep. All parts of the skin, including the head, ears, and tail, must be treated, and poisonous dip must not be used. When irritation is due to causes other than lice it may be necessary to wash once only with a weaker solution, and follow with a dose of castor-oil (from 2 oz. to 4 oz. according to age) on the following day. It will be found advantageous to wash and drench all calves at weaning, when the drench should not be more than 4 oz. (8 small tablespoonfuls) castor-oil and 1 small tablespoonful turpentine in 1 pint of milk.

The advantage of hornless cattle is so extensively realized that it is surprising so few farmers take advantage of the simple method of preventing the growth of horns on calves by the application of caustic potash to the horn-buds when the calves are from four to six days old. To do this clip the hair from the horn-buds and scrape the skin lightly to remove scurf; then dip the end of the stick of caustic in water and apply the dressing to the skin over the horn-buds. If this is properly done at the age stated the horns will not break through the skin, but if carelessly done, or done when the calf is over a week old, unsightly horn-stumps will probably develop. The caustic must be kept in an airtight bottle, as it will quickly dissolve if exposed to the air. The operator should be careful not to let the caustic come in contact with his skin.

BUSH SICKNESS.

PROGRESS OF THE INVESTIGATION.

A VISIT was made last month by the Hon. W. D. S. MacDonald, Minister of Agriculture, to the Department's bush-sickness experimental farm at Mamaku, in order to look into recent operations carried out there. Mr. MacDonald, who for some time represented the district, has taken a keen practical interest in the bush-sickness investigation for a number of years. In the course of an address given by him at Rotorua during his visit to the district Mr. MacDonald, after paying a tribute to the work of the departmental officers concerned, made the following statement on the subject under notice:—

The progress of the investigation into the cause of bush sickness and the measures necessary for combating it has been necessarily slow, seeing that each of the various experiments which have had to be undertaken with cattle and sheep have occupied any time from six months to two years. But, though slow, steady and definite progress has been made, and the position to-day may be summarized as follows:—

1. The cause of the trouble lies in the fact that the soil is deficient in certain chemical constituents which should be available to be taken up by the herbage if animals feeding upon it are to maintain sound health and condition.

2. Analyses of soil, grasses, and parts of the bodies of animals living in the affected country all show a deficiency of iron as compared with what is found in outside "healthy" country.

3. Treatment of affected animals with syrup of phosphate of iron, if continued steadily over a sufficiently long period (from eight to twelve weeks), will effect a cure even in animals in the advanced stage of the trouble and kept entirely on bush-sick land during treatment. This has been proved over and over again. Licks containing iron have also proved useful, although not so certain in their effects as the administration of the syrup of phosphate of iron. Experiments in the direction of applying medicinal treatment in a simple way by treating the drinking-water are also in operation.

4. It is recognized that treatment such as this, while of the utmost value as proving the correctness of the opinions arrived at as to the cause of the trouble, is not to be looked upon as a final solution of the matter, seeing that it involves time, trouble, and expense.

5. What is really required, and what the Department is aiming at, is to find a means of prevention; in other words, to endeavour to do away with the cause of the trouble. With this in view experiments in treating the soil have been carried out, and up to a certain point these have been very successful.

6. It has been proved that the application of phosphatic manures, in the form of top-dressing, so improves the soil conditions that both cattle and sheep can be carried in good health for a much longer period than they could be on non-treated land. In addition, the generally increased nutritive value of the herbage enables the animals to do better in every way. The particular value of the top-dressings lies in the fact that they stimulate root-growth and root-action in the food plants, thus enabling them to take up more iron. There is iron present in the soil, but it is almost entirely in the form of silicate of iron, which is extremely insoluble and unavailable for plants. It is probable that some chemical action takes place as a result of phosphatic manuring which renders some of this iron available.

7. Our experience at Mamaku Farm shows that the application of suitable top-dressings increases the value of the land for grazing purposes by at least 75 per cent., and possibly 100 per cent. for the time being. When the effect of the first top-dressing has disappeared the land is still better than it was at the beginning, and though further manuring is then needed a tangible and permanent increase in the value of the land has been attained, and it only needs good farming to continue this. As the soil becomes more consolidated as a result of carrying an increased quantity of stock, and at the same time accumulates humus, it will become more naturally fertile, require top-dressing to a less extent, and become more healthy for stock.

8. The most suitable manures for use as top-dressings are, in order of merit, as follows: (*a*) Superphosphate and basic slag—equal parts mixed; (*b*) superphosphate and lime; (*c*) guano. Basic slag alone, though it produces an abundant growth of herbage, does not seem so suitable for combating bush sickness as do the manures above mentioned. This is probably due to the lime contained in it. Lime alone seems to do more harm than good in connection with bush sickness.

9. With our present knowledge it is clear that with good farming methods and the judicious use of top-dressings the land affected can be profitably utilized for grazing and fattening stock—both sheep and cattle. Grazing operations on these lines have paid handsomely at the Mamaku Farm. Dairying has also been carried on at the farm, and will continue to be carried on; but it is clear that we have not yet reached a stage when settlers can be confidently advised to take up this land for dairying purposes if they intend to carry their cows on the land continuously year after year. We have been able to milk some of the farm cows for two seasons successively, but no longer, and not in the case of all of them; and it is still a most difficult matter to rear calves to maturity. No doubt if we had given the cows a change to outside country once a year they could have been carried on, but to do this would have destroyed the true value of this branch of the experimental work, since it would have been only repeating what is already being done successfully by settlers in the district.

10. The research work will be carried on vigorously, and a new series of experiments is about to be initiated. A soil survey of all the known affected area is also to be carried out.

MARTON EXPERIMENTAL AREA.

THE following notes, dealing with the chou moellier crop, subsoiling, &c., are furnished by Mr. G. de S. Baylis, Fields Supervisor, in continuation of his report, published in the July issue of the *Journal*, on operations at the Marton experimental area:—

It may be restated in the first place that the experiments at present being carried on at Marton are a rotation course for the improvement of the soil, consisting of clover or similar crop for two years, or Italian rye-grass and clover followed by wheat, which in turn is followed by a root crop, or rape, kale, chou moellier, &c., then oats, and again Italian rye and cow-grass, or permanent pasture if it is desired to throw the land out of cultivation. When possible it is also intended to disk oat and other stubbles after harvest, and, if the season permits, drill in a few pounds of Italian rye, or suchlike, to be used as green fodder during the winter, and plough under in the early spring, thus affording the land a certain amount of humus-supply and also dung from the stock consuming the green feed. Disking directly after harvest also assists to clean the land, and at the same time to promote the germination of weed and other seeds shed thereon, which plants in their turn are destroyed when the catch-crop is ploughed under.

The notes taken with regard to chou moellier during the past season are to the effect that this crop suffers just as severely from the attacks of turnip-fly, during the early stages of growth, as do swedes, &c. When fully grown, however, while an adjoining rape crop was consumed by cabbage-moth and aphis, leaving nothing but the bare stump, just as if it had been hard grazed by sheep, the chou moellier was still affording an abundance of leaf.

The first sowing of chou moellier was entirely taken by fly, and a second sowing was necessary. Gaps were also made by the fly in the second sowing. As the early hay crops were ready for cutting before the chou moellier plants were ready to transplant, labour for transplanting was not available; hence, seeing that uniform conditions did not exist, the taking of grazing-records for comparative purposes was not advisable. It was also not advisable to incur the expense of separately fencing and recording the chou moellier plots.

Italian rye-grass being sown in all oat and wheat stubble and other plots, the feeding-off of the chou moellier was deferred until such time as the Italian rye should be fit for feeding, which was not until the end of May. During the interval the leaves of the chou moellier were consumed bare to the very ribs by the blight. Thus a first feeding was lost. When the rains came the crop rapidly recovered, but the lambs (tegs) neglected to a large extent the old growth which had suffered from blight, treading this under while they consumed the later and fresher growths. The results are as may be imagined—that whereas the average grazing-capacity of 1 acre of chou moellier last season was 100 lambs for twenty-two days, this season the average would probably be 100 lambs for rather less than ten days. This affords a positive proof, if any were necessary, that when a crop is badly attacked by blight considerable monetary loss is likely to ensue unless the crop is fed off at once. There does not appear to be anything gained by restraining from feeding off when blight attacks the crop, as the stock largely destroy any of the older growth which may to a certain extent have escaped the blight, while seeking the fresher growths which are more palatable. Neither is additional vigour retained by the plant.

Chou moellier has now been used at Marton for two consecutive seasons, and the lambs have done well on it. The practice is to sow about 1 lb. of good germinating seed in drills 28 in. apart, and horse-hoe as soon as the plants are sufficiently in evidence. This clears the weeds from between the rows. Later, for a second cultivation, the double mouldboard plough is run between the rows, and, while moving the intersurface, this covers up most of the small weeds growing between the plants in the rows, thus avoiding much hand-work. Wet weather in August retarded ploughing operations. One of the clover plots in each of the sections was, however, turned over about the end of that month.

Since the land has been properly drained with the mole-plough it is noticeable that even after very heavy rains, such as have recently occurred, the water gets away very quickly, and the land soon becomes sufficiently dry for working operations. Italian rye made good growth

all the winter and carried a fair number of stock. This I largely attribute to drainage.

On the acre which was subsoiled the clay beneath the top-soil is still loose and friable to a depth of 3 in. or 4 in. This plot yielded 84 cwt. 2 qr. 14 lb. pure clover hay per acre. The non-subsoiled plot yielded 55 cwt. 4 lb. per acre. Both plots have also afforded a good deal of grazing. On the subsoiled plot the clover-plants have stout roots and heavy crowns, the roots being dragged out by the plough and broken off at an average distance of 12 in. to 14 in. from the crown. On the non-subsoiled plot the roots are much thinner, and the crowns not as heavy, nor the plants as well developed. They break on an average, say, of 9 in. to 10 in. from the crown. This gives a very good idea of the increased depth at which the clover crop is feeding on the subsoiled plot, and is an indication that the method adopted is realizing its object—namely, gradually increasing the depth of cultivable soil on the Marton area.

The subsoiling at Marton was done in 1914 by a P. and D. Duncan subsoil attachment to an ordinary double-furrow lever plough. One mouldboard was removed and the subsoiler attached, ploughing and subsoiling thus being accomplished at the same time. On the stiff clay lands at Marton a five- or six-horse team is advisable if deep ploughing and deep subsoiling are to be undertaken at the same time. At the experimental area the land was ploughed to a depth of about 6 in. and subsoiled to a further 4 in. or 5 in. With the attachment used it was quite possible to plough both furrows and subsoil same at the one operation. If it is only intended just to loosen the surface of the subsoil it is quite possible to do so with the ordinary team, but when any considerable depth is undertaken a stronger team becomes necessary.

The cost of ploughing and subsoiling land similar to the Marton area, contrasted with the cost of ploughing in the usual way with a double-furrow and a four-horse team, may be stated as follows: If a depth of, say, 6 in. or 7 in. is ploughed, and a further 3 in. to 4 in. subsoiled, five or six horses will be required, according to quality, instead of four, and one furrow will be ploughed while the other is being subsoiled, thus taking as long to plough the acre as if you were using a single-furrow plough.

As to how often it may be necessary to subsoil on the class of country mentioned, I am not able to state more at present than that subsoiling at Marton was undertaken two years ago, and that, as indicated, the clover crop of the past season proves the fact that not only is the subsoil still free to the original depth stirred, but that the clover-roots are now feeding therein. This shows that such cultivated area of the subsoil is now providing plant-food, and that therefore the nature and condition of the subsoil has been changed from what it originally was—namely, inert matter practically of little value to the plant.

The chou moellier plots were disked after the stock were removed, and subsequently ploughed. On the green-manured sections there still remains abundant evidence of the green oats which were ploughed under in August, 1915. Much of this material should now be in condition to afford fertility to the soil during the present season.

A MOTOR-CAR TRAILER FOR MOVING BEES.

A CONVENIENT and effective bee-transport trailer for use with a motor-car has been designed by Mr. Robert Gibb in connection with his Menzies Ferry Apiary, Southland. For some years past Mr. Gibb has moved large numbers of colonies to the Kamaki Bush each spring for the early bush flowers, a distance of four miles. Hitherto the bees have been carried on a light cart holding nine hives, and consequently many trips had to be undertaken at great risk to the owner. The ability to dispense with the

MR. GIBB'S BEE-TRANSPORT TRAILER.

horse conveyance and to bring into use the light home-made trailer under notice has enabled Mr. Gibb to carry a load of 12 cwt. at one trip, running at fifteen miles an hour, the road being a good one. The photograph shows a load of thirty-six supers fitted with combs on their way to the bush, and bears evidence of the practical use that can be made of a motor-car in beekeeping.

The following is a specification of the trailer: Wheels, solid rubber tires off an old motor-car; axle, 1½ in. steel; springs, as for milk-cart; body, 8 ft. long; understructure, two 8 ft. 4 in. by 2 in. lengthwise pieces, and three 3 in. by 2 in. cross-pieces,

all of red-gum; upper structure or decking, one piece 2 in. by 2 in., 8 ft. long, along centre, to keep hives from butting each other; four pieces of 6 in. by ¾ in., each 8 ft. long, for hives to rest on; draw-bar (two arms), for attaching to back of motor-car, round steel, 1 in. in diameter, bolted to each of the 8 ft. 4 in. by 2 in. main beams. Eye of draw-bar attached to hook on back of car.—*E. A. Earp, Apiary Instructor, Dunedin.*

A RAISED FEEDING-TROUGH FOR POULTRY.

EVERY poultry-keeper knows how the ordinary feeding-trough placed on the floor of the house gets filled with litter from the scratching of the birds. The accompanying photograph illustrates a useful style of platform for raising the trough above the floor.

THE RAISED POULTRY-TROUGH.

It saves the trouble of removing litter from the trough before feeding, and takes up practically no floor-space, as the birds have room to scratch underneath it, any crowding being thus minimized. The trough shown is made of 6 in. by 1 in. boards, 7 ft. long, and the platform of 8 in. by 11 in. boards nailed securely at each end to pieces of 12 in. by 1 in., 28 in. long. The trough is unattached to the platform.—*A. E. Salisbury, Poultry Instructor.*

ONION-CULTURE.

W. H. TAYLOR, Manager, Arataki Horticultural Station.

ONIONS can be successfully grown on various classes of soil, but it is essential that the soil be of a nature that will not readily bind under hot sunshine nor run together with heavy rains. It must be well drained, and worked to a depth of at least 18 in. Upland pasture land, drained swamp land, rich river-flats or loamy plains, all alike are suitable. The condition required is a soil that can be readily worked to a fine surface, and that will remain porous under all conditions of weather.

Though there are many varieties of onions, they may be broadly divided into three classes: (1) The giant kinds, (2) keepers of moderate size, and (3) early-maturing kinds. Pickling-varieties may be added, though the pickling-quality is largely a matter of cultivation.

The giant kinds are, as a rule, successfully dealt with only by sowing in autumn, although if sown in spring they are likely to develop comparatively large bulbs. They are really not to be relied on to bulb at all; it is largely a matter of weather. The ideal season for onions would be a gentle spring with a fair rainfall, a fair amount of rain till the middle of January, and a dry autumn. A dry summer and wet autumn is bad for onions; rain at that time excites growth and mars the keeping-properties of the bulbs. In the case of large kinds sown in spring, unseasonable rain would probably prevent them bulbing. Large bulbs require a lengthy period for growth, and this is only obtained by sowing in autumn. Sowing too early, however, is dangerous. There is a time in every district that is best, but just when that time is requires some local experience to define. If the seed is put in too late there will be insufficient growth made by planting-time; if sown too early there will be too much growth. To use an expression common to the horticultural craft, there will be "too much autumn" in them, and the majority will bolt to seed and be utterly worthless. Autumn-sown onions must be transplanted; if this is not done many of them will run to seed, and those that do not will never have any keeping-qualities.

In some districts it is rare to get really good bulbs from spring-sown seed. The principal reason for this is frequency of attack by mildew. In these circumstances autumn sowing of keeping-

varieties is frequently resorted to, as large bulbs can be secured by that means, the reason being that bulbs are usually fully grown before mildew intervenes, which is seldom till after mid-summer. It is well, however, to repeat that these bulbs are rarely good keepers, but provide good samples for early sale or home use.

The time to sow in the Wellington Province, or the middle district, is the last week in March or the first week in April. Probably three weeks earlier is best in the colder parts of the South Island. The time for spring sowing varies to a greater extent, being ruled by the condition of the soil as affected by rain. In the immediate precincts of Wellington spring rains do not prevent early sowing. Similarly, where the soil is porous to a considerable depth other districts are not affected. Early in July is the best possible time in such places. Where the seed can be got in at this time the crop is very unlikely to be prejudicially affected by mildew, for the crop will be practically matured when mildew appears.

It is, however, useless to sow the seed unless experience teaches that the soil will remain in a condition favourable to growth, a condition not present on flat lands with a heavy subsoil. In such places seed-sowing must be delayed till the sun gains more power; in some places it is necessarily delayed till the first week in September. The quality of the crop is then to a large extent dependent on autumn weather and the occurrence or non-occurrence of mildew. The bulbs from such late sowing are usually of medium or below medium size.

Mildew can be controlled only by spraying before the disease appears. It is possible to ward it off, but it is not possible to prevent loss if it attacks the plants. The remedy I have experience of is Bordeaux mixture, of which it is not safe to apply a greater strength than 2-2-40.

PREPARING THE SOIL.

Whatever the means the soil is prepared by, it should be done some weeks before sowing or planting. It is not always possible to do this, and in such cases extra labour at sowing or planting time is necessary in order to ensure a good bed. The soil should be well worked, all lumps broken up by disk harrows, good use made of the tine harrows, and the surface well rolled. A clod-crusher made of a heavy slab cut from a tree, with one surface flat, or made of lapped boards, is very useful for breaking the surface to a fine tilth and for making an even surface. Garden plots are, of course, dug with spade or fork. After raking the ground

level, tread the whole surface down firm with the feet. Never attempt to work the soil when it sticks to the tools or implements.

SOWING THE SEED.

In gardens the drills may be 12 in. apart—just leaving room for the hoe. With large lots more space is required so as to give room for a Planet Junior or similar machine; 15 in. is sufficient. For garden lots make the drills with either the corner of a rake (not a hoe), or with a marker made for the purpose. The drills must be just deep enough to allow of covering the seed—no more. Cover the seed by straddling the drill, and drag the soil in with the heels of your boots. This is as quick as raking, and ensures perfect and even covering. After covering in, lightly rake in the direction opposite to that in which the drills run—across the drills, in fact. This prevents water settling in the drills. The Planet Junior has an attachment which marks the line for each drill at any distance apart which it may be set for. The machine makes the drills, sows the seed, and covers it in. Finish by turning a set of light harrows on their back and drawing them over. The quantity of seed to sow is 3½ lb. per acre, but 1½ lb. to 2 lb. is enough to allow per acre when transplanting is to be adopted.

AFTER-CULTIVATON.

The surface soil must be kept open by the means suitable to the extent of the work. Weeds must be kept out, and a certain amount of hand-hoeing is necessary along the lines. Thinning should be done early; in the field a large amount of it can be done with a sharp hoe in skilful hands. It is important that extreme care be exercised in setting the machine, so that the seed be not sown too thickly, as this factor largely rules the amount of labour involved in thinning, which would be formidable unless due care was taken in the manner indicated. Unless the plants are evenly spaced the size of the bulbs will be very uneven. Plants may stand 3 in. to 4 in. apart, and need not be in single file.

PLANTING AUTUMN-SOWN SETS.

This may appear to be a formidable undertaking. It largely depends on the inventive powers of the planter, and also on the speed of the workmen. Drills should be made with a marker. The sets should be dropped by one workman and fixed by another. The plants need not stand up. Merely lay them on their side and place a little soil over the roots, making it somewhat firm. The plants will soon assume an erect position. Plant keeping

kinds 4 in. apart, and large varieties 6 in. or more, according to the size of bulb required. In gardens where large bulbs are required they should be 12 in. apart, but a less distance for market work.

The amount of labour involved in planting is more apparent than real. It is largely set off by after-ease in cultivation—no thinning and far less weeding. Moreover, the crop matures earlier than those from spring seeding. The bulbs being early on the market find a more ready sale. I have no hesitation in saying, from my reading and experience, that at least in places where an early spring start is not to be had the planting system would prove the more profitable.

MANURES AND FERTILIZERS.

Wood-ashes are of great value, not as fertilizers only, but as a help in keeping the soil open. They should be applied liberally during final prepartion of the surface.

Stable and farmyard manure, when it can be obtained, should be applied at first ploughing at the rate of 15 to 20 tons per acre. Soot acts as a fertilizer and insecticide. Apply just before sowing, sufficient to show over the whole surface. Superphosphate and bonedust can be used at the rate of 1 oz. each per square yard, equal to 2½ cwt. per acre. Sulphate of potash may be applied at half the latter quantity. These fertilizers should be applied some time before planting. With nitrate of soda, two applications each of ½ oz. per square yard should be given—the first when growth begins, the second some time later, when growth is well established. The nitrate should be sprinkled along the rows of plants, preferably when light rain is falling.

PICKLING-ONIONS.

These are obtained by sowing thickly on poor soil about the middle of November. The plants are not to be thinned, and the soil should be of a free character, made very firm.

VARIETIES RECOMMENDED.

Large kinds: Ailsa Craig, Prizetaker, Cranston's Excelsior.

Keeping kinds: Brown Spanish, James Keeping, Golden Globe, Spanish Silver Globe.

For quick bulbing: Silver King, White Italian Tripoli, Extra Early Barletta—suitable for hot climates. These do not keep, but bulb very early, and are excellent for early market work, particularly if sown in autumn and transplanted.

For pickling: The Queen, Silver-skinned.

THE LIME-SULPHUR SPRAY AT RUAKURA.

T. B. ROACH, Horticultural Overseer, Ruakura Farm of Instruction.

DURING the past season lime-sulphur was the principal spray used at Ruakura, and, in the main, it gave highly satisfactory results. Though much has still to be learnt about the merits of this spray, enough proof is forthcoming to satisfy the orchardist that he has something superior to anything available in the past as far as a summer spray is concerned.

During the season experiments with lime-sulphur *versus* Bordeaux mixture were tried on several varieties of apples and pears, and in every instance the lime-sulphur solution showed its superiority, particularly on the apples Gravenstein and Willie Sharp. These varieties when sprayed with lime-sulphur carried respectively a crop of 193 lb. and 137 lb. per tree, against 114 lb. and 124 lb. yielded by those trees sprayed with Bordeaux mixture. A noticeable feature was the effect of the respective sprays on the fruit of these varieties. With lime-sulphur no russeting of fruit followed, but fruit on the trees sprayed with Bordeaux mixture russeted to such an extent as to render 30 per cent. unsaleable.

A further trial with lime-sulphur, covering trees of numerous varieties, provides important data with regard to the strength at which the spray may or may not be used. Most readers are aware that some varieties of apples and pears are more tender than others, and care should therefore be exercised when applying the spray mixtures. Lime-sulphur applied at a strength of 1 gallon of solution to 80 gallons of water gave results fluctuating to a considerable extent. On the varieties of apples Dougherty, Irish Peach, Sharp's Midseason, Allington Pippin, Welcome, Jonathan, and Commerce results were all that could be desired. Only fair results followed its use on Byford Wonder, Cox's Orange Pippin, and Cleopatra. Severe scorching was a result of its use on the varieties Lady Sudley and Roundway's Magnum Bonum.

A similar experiment conducted over several varieties of pears also showed fluctuating results, though not so marked as in the apple experiment. Russet markings on the skin of the pear do not decrease the value of the fruit on the market to the same extent as on the apple. Scorching of the foliage represented the main damage done by the lime-sulphur to those varieties included in this experiment. Williams Bon Chrétien, Thompson, Beurre

Diel, Winter Bartlett, Emile de Heyst, and Howell showed no scorching of foliage. Poire de Berriays, Harrington's Victoria, Richmond Beauty, Beurre Bosc, and Marie Louise D'Uccle were varieties badly scorched, Harrington's Victoria suffering to the greatest extent. Russeting of fruit occurred on P. Barry and Directeur Hardy. A weaker strength than 1 in 80 should therefore be applied to those more tender varieties, and a strength of 1 in 100 may be recommended instead. The strength at which the lime-sulphur should be used is certainly a very important point to the orchardist, for the stronger the solution is applied without being detrimental to the fruit or tree the more completely will fungoid and insect pests be controlled.

It may be stated that the initial experiments with lime-sulphur at Ruakura gave anything but satisfactory results. The first season's trials were conducted at too great a strength. Repeated experiments, covering a wide field of variations, are the only means of gaining definite information on subjects of this nature. One experiment must follow another if anything of real value is to be achieved. Suggestions for future trials must have for their foundation data emanating from the results of former trials. Results are in most instances neither glaring nor conspicuous, and can only be arrived at after careful observation and study.

Since lime-sulphur has become one of the principal sprays in the Ruakura orchard powdery mildew has been practically wiped out. This disease was very prevalent in 1913, and, according to past records, was then on the increase, though all trees received regular sprayings of Bordeaux mixture. Exactly the same results as regards red mite followed the introduction of lime-sulphur. This pest is one that can do an immense amount of damage, and the extent to which it may rob a tree of its vitality is seldom fully recognized by the orchardist.

There can be but one conclusion from the above facts—namely, that lime-sulphur as a summer spray must command precedence over Bordeaux mixture.

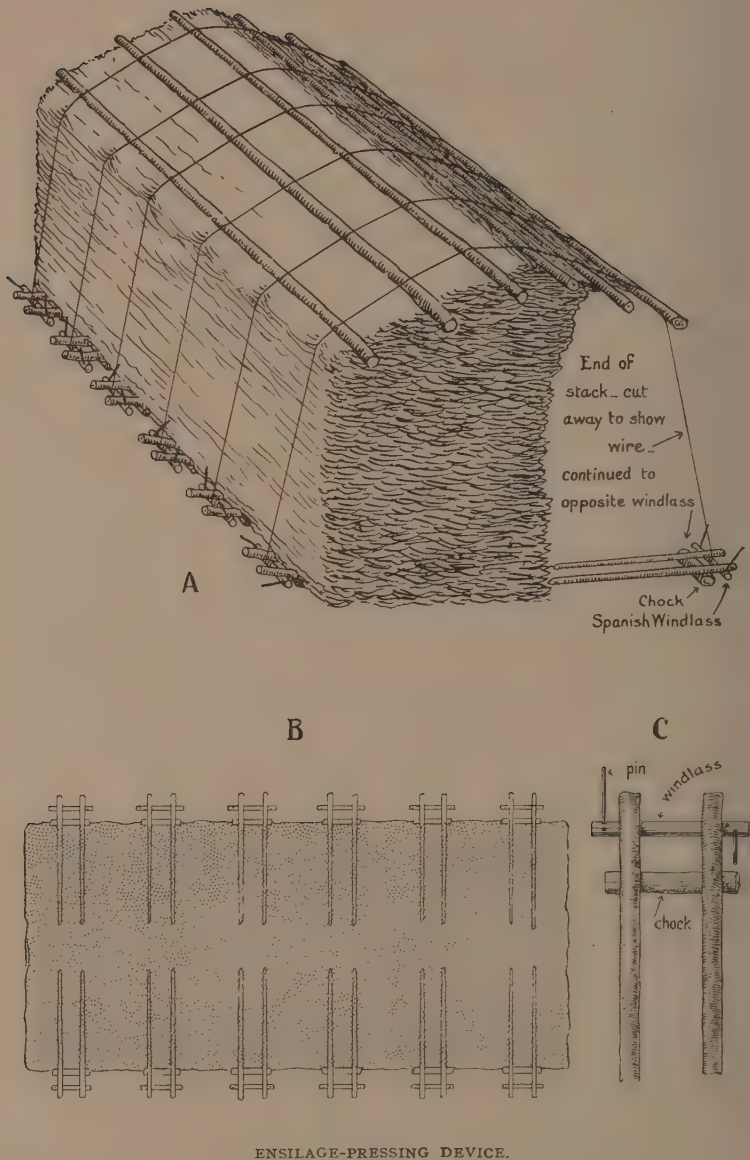
Chatting recently with an officer of the Department a Marlborough farmer put in a good word for the small birds. He mentioned that many years ago, when the birds had not multiplied to their present numbers in his district, the barley crops were frequently ravaged by caterpillars. As showing the severity of the pest, he told of a case in which a neighbour's barley had been wiped out by the caterpillar. The insects then began to cross a road dividing the destroyed crop from a paddock of barley on the opposite side. The owner of the threatened field successfully met the invasion by driving a roller up and down the road, crushing the caterpillars in masses. Of late years (presumably owing to the increase in the numbers of birds) Marlborough has been free of the pest.

AN ENSILAGE-PRESSING DEVICE.

THE usual method of pressing ensilage material when stacked—by weighting the stack with earth, &c.—involves heavy lifting, and has other drawbacks. An alternative method of pressing the stack by means of strained wires, while not a new device, appears to be very little known in New Zealand. As illustrated in "Stephens's Book of the Farm," this method requires the use of manufactured metal apparatus. Particulars of a simple and effective pressing-device on the same principle, but for which all the necessary material is available on most farms, are supplied by Mr. C. T. Middleton, of Sumner, near Christchurch, who states that he adopted the device in Australia many years ago (as an original idea), and intends to use it on his farm this season. The following details, read in conjunction with the sketches on the next page, should enable any farmer to readily carry out the method described:—

"When preparing the site for the stack place sets of two fairly stout poles, 8 ft. long, every 4 ft. or 6 ft. on either side of the bottom, leaving 18 in. space between the poles forming each set. 6 ft. of the poles should be under the stack and each set opposite the other on the two sides. This will leave 2 ft. of the poles projecting. Under each set and in line with the side of the stack put a stout chock of wood, which will raise the projecting ends of the poles from the ground. Next take a "Spanish windlass" for each set of poles. This can be easily made by sawing off proper lengths of any round hardwood, such as the branches of gum-trees, and making the necessary holes with a brace and bit (the apparatus being on the same lines as a roller for straining wire on fences). As soon as the stack is built and properly topped place poles along the top; then, having the windlasses in position under each set of ground poles, connect each pair with stout fencing-wire and strain away. The poles on top serve the purpose of giving an even pressure over the stack, and at the same time prevent the wire from cutting into the ensilage material. A very heavy even pressure is thus obtained, and it is a very simple matter to give the windlasses a turn every now and again until the stack becames a solid mass. A covering of straw or similar material will then exclude rain."

It is not claimed for this device that it would necessarily take the place of the ordinary method of pressing under all conditions and for every sort of ensilage. The many different points of ensilage-making, as regards class of material, curing-temperatures, &c., should, of course, be taken into consideration in each case.



ENSILAGE-PRESSING DEVICE.

A. Sketch of stack, with apparatus in position and wires strained. B. Plan of stack-bottom, showing arrangement of poles and windlasses. C. Detail of wind ; arrangement.

WATERPROOF AND WAX-BEARING SOILS.

B. C. ASTON, F.I.C., Chemist to the Department.

FROM time to time instances of soils which will not wet have puzzled farmers, who have sent in samples from different localities for examination. These samples were, for the most part, small and represented areas widely separated.

A paragraph in my 1909 report (Annual Report of the Department, 1909, p. 469) mentions, under the heading "Abnormal Soil-constituents," three soils (J 194, from Mataroa; J 265, from Gisborne; and K 2161, from Pukutoatoa, near Woodville) to which the term "waterproof soils" had been applied, as it was stated that it was impossible for rain to wet them, the result being that nothing would grow.

Mr. C. P. W. Longdill, of Taihape, writing to the *New Zealand Times* in April, 1907, says, "At Mataroa, a small township on the Main Trunk line, six miles north of Taihape, there is a curious natural phenomenon in the form of a patch, several square yards in extent, of soil, or rather dust—for nothing will grow upon it—which seems perfectly impervious to moisture, so that, even though it rains in torrents and pools of water collect upon the area, a scratch on the surface causes the dust to rise and float on the top of the water as dry as a water-spider. Can you or any of your readers explain the reason of this? It is quite possible that this dust, being waterproof, might be converted into some substance of considerable commercial value."

Inspector C. Watson reported on this in May of the same year as follows: "I went to Mataroa and examined the soil, of which I am forwarding a sample. The patch of soil, ½ chain long by 2 or 3 yards wide, is located near Smith and Donald's sawmill, on the top of the bank of a creek several feet above the water-level. I did not ascertain the depth of soil. During the recent rain the surface of the patch of soil has been composed of thin mud ¼ in. deep, and several pools of water have collected in depressions. When the surface layer of mud is removed the dry dust is found underneath. The ground adjoining is in grass; it has been bush-clad, but the bush has been fallen years ago and the bulk of it burned off; the surface soil is vegetable loam, with light clayey subsoil. Nothing is known locally of the patch of

soil in question further than that it is impervious to moisture. One and a half chains away is a salt-water spring."

Shortly after, Mr. T. W. Tiffen, of Wheturau, Gisborne, writing me in July, 1907, says, "I am sending you a sample of soil from my property which is in its way an agricultural curiosity. It possesses the peculiarity that, excepting to the depth of 1 in. from the surface, it appears never to get wet. This soil is found in patches. It is very light, and floats readily on water. Outside these patches the ground is now sodden with water. It has struck me that the explanation may be either that these are patches containing a large amount of pumice, or that it may be fuller's earth or something of the sort. I have watched these patches for six years, yet all through the winter they appear to be dry. I shall be glad to know what you make of it."

My report on the above stated, These small samples of fine sandy loams have been experimented with as far as their size would permit. The size of the particles, the combined water and the organic matter appear perfectly normal. The phenomenon is probably due to one of two causes: either to the way in which the air-spaces are locked in, or to the presence of some resinous or oily substances as from pines or other resinous trees. After ignition water is readily absorbed, as also after thorough kneading with water and subsequent drying, or after washing the soil with alcohol or ether. Ether extracts a small quantity of resinous substance from the soil. In order to extract enough of this resin for analysis a large amount of soil would be necessary—say, about 2 cwt.—but as the soil occurs only in patches it is hardly worth while.

Early in 1909 Mr. P. H. Lynch, of Pukutoatoa, near Woodville, left a sample of soil at the chemical laboratory with a statement that the soil over an area 6 yards in diameter would not wet, and that no grass or weeds would grow. An examination of the small portion showed that ether extracted from the soil 0·3 per cent. of a resinous matter, which united with alkali, forming a soap. The extract melted easily, with a smell of pine, and the ethereal solution was slightly acid. I reported in February, 1909, that the resin was probably derived from resinous trees originally growing on the site of the dry patch.

Up till this time the investigation was in an unsatisfactory state, owing to the smallness of the samples submitted. The discovery of fairly large areas of dry patches occurring at the Ruakura Farm of Instruction, on the portion situated on what was originally a part of the great Piako Swamp (now better known as the Hauraki Plains), has drawn fresh attention to the phenomena of waterproof soils. In this case there was no difficulty in securing

a large amount of soil for examination. Mr. Green, Manager of the farm, writing in September, 1915, states, "This class of soil remains practically dry throughout the winter. After heavy rain the water lies on the surface and will not penetrate into the soil. It is difficult to secure a crop there, owing to insufficient moisture to germinate the seed. The soil is apparently full of rotten wood. If ploughed and left for a few months sorrel appears and spreads, making a thick mat of roots. The method I am adopting to bring this land into cultivation and to prepare it for permanent pasture is to apply lime and sow with rye-grass for the present; then stock heavily, feeding out mangels and hay during winter. I should be pleased if you could arrange to have the soil analysed, and would be glad to receive any suggestions as to treatment."

The soil contained the following constituents, calculated on the sample dried on the water-bath:—

	Per Cent.
Loss on ignition	34·740
Total nitrogen	0·726
Hydrochloric-acid extract—	
Phosphoric acid (P_2O_5)	0·132
Potash (K_2O)	0·041
Lime (CaO)	0·189
Magnesia (MgO)	0·069
Citric-acid extract—	
Phosphoric acid	0·074
Potash	0·024

I reported that the sample was a humus soil rich in available mineral plant-food, and suggested as a form of treatment an attempt to consolidate the ground by close stocking and feeding on the dry areas, thereby consolidating the soil by tramping and manuring the organic (peaty) matter of the soil by the animals. It will be seen that if one could imitate the action of the pestle and mortar on the soil during rain the same beneficial result might ensue as when the soil is so treated in the laboratory.

The next step was to examine the effect of exhausting a large quantity of the soil by a solvent. Some 30 lb. of the soil dried on the water-bath was therefore extracted by alcohol in an apparatus in which a constant stream of hot strong alcohol was allowed to percolate through the soil. The alcoholic extract on cooling deposited a mass of yellowish crystals of a scented wax which was found to be present to the extent of 0·8 per cent. of the dried soil. The air-dried crude wax commenced to melt at 65° C. and

was completely fluid at 80° C., cooling to a lustrous brown solid. The chemical and physical examination of this wax is now being carried out. That the abnormal character of this soil is probably due to the wax is indicated by the fact that a sample of the soil which had been exhausted by alcohol and subsequently thoroughly dried wetted easily on contact with water, which spread rapidly throughout the mass. Again, if an alcoholic solution of the wax were added to the dry wax-extracted soil and the whole dried, the waterproof nature returned and the soil could not be wetted by mere contact. If kneaded in a mortar with water the original dry soil became thoroughly wetted; on drying it on the water-bath the difficulty in wetting it returned.

The most interesting point about this research is the origin of the wax, which may be due to one of a variety of dissimilar sources, probably of a vegetable nature, such as from algæ, diatoms, or bacilli. As, however, the wax in this case occurs on the surface soil the possibility of it being derived from higher vegetation must not be excluded. Virgin portions of the drained swamp at Ruakura at present grow a dense thicket of manuka (*Leptospermum*, family Myrtaceæ), as well as rushes, sedges, mosses, liverworts, and similar swamp-loving plants. Since the swamp has been drained bracken fern (*Pteris esculenta*) has taken possession of certain areas, while huge logs occurring throughout the swamp indicate that such swampy forest-trees as kahikatea or white-pine (*Podocarpus dacrydioides*), pukatea (*Laurelia novae-zealandiae*), occurred; and the smaller growth of such plants as phormium (family Liliaceæ), a strong wax-bearing plant, toetoe (*Arundo conspicua*), bullrush (*Typha*), and cabbage-tree (*Cordyline australis*, family Liliaceæ) is also indicated.

Since receiving this Ruakura soil a yellow humus subsoil occurring near the sea in the far south under a peaty soil has also become the subject of investigation. Upon this subsoil nothing would grow. On ignition in a closed crucible the dried sample lost 34 per cent. of matter, burning off with a white flame (the "hydrocarbons" of the coal analyst). It yielded to alcohol and to ether a much greater quantity of extract than did the Ruakura soil (as much as 4 per cent.), and then still contained volatile matters which could be distilled at a gentle heat.

This being probably the first occasion on which these abnormal constituents have been noticed in New Zealand soils, it is deemed advisable to publish this preliminary notice, as the result of the investigation may be found to throw some light on one theory of the origin of petroleum, while the discovery of the occurrence of wax in such quantity may have a decided economic value.

CERTIFICATE-OF-RECORD DAIRY COWS.

A WORLD'S RECORD.

W. M. SINGLETON, Assistant Director, Dairy Division.

NEW ZEALAND'S system of certificate-of-record testing has been in operation only four seasons, but the authenticated records of the best producers in each class have given us reason to believe that there are in this Dominion strains of purebred dairy cattle equal to anything in other countries. Until the present month (6th

MERE.
Photo taken at the commencement of her milking-period.

October), however, we had not been in a position to grant a certificate on a production of butter-fat that constituted a world's record for the class according to the age of the animal at commencement of test.

So far as our office records give us an indication, we believe that we now have in New Zealand the world's best yearling in Mere, owned by Mr. F. S. McRae, of Palmerston North. This heifer commenced milking at the age of 1 year 346 days, and in 365 days has a credit for 12,164 lb. milk, containing 663·64 lb.

butter-fat. In the world's class for yearlings the butter-fat record of Mere displaces that of a sister of Woodcrest Joe, the Department's Friesian bull at Weraroa. This heifer, Woodcrest Colantha Pietje, owned in the United States, has a yearling record of 20,859·7 lb. milk, containing 639·62 lb. fat, which then constituted a world's milk and fat record for her class. Mere's record is all the more creditable by reason of her having again calved, just thirteen months after the commencement of her test now under notice.

The pedigree of Mere, especially on the dam's side, will be interesting to New Zealand Jersey fanciers. The importance of pedigree study is being recognized more and more. Mere's dam was Tiki. This cow was entered for test, but met with a misfortune shortly after calving and died. She gave promise of great production. Tiki's dam was Charm, owned by Mr. McRae, and while under test as a four-year-old produced 572·52 lb. fat from 9,980 lb. milk, becoming class leader. Charm was from Floss III, a grand old cow, which, starting test at almost eleven years of age, produced under unfavourable conditions in 309 days 10,259·25 lb. milk and 476·56 lb. fat. Charm and Floss each dropped a calf within fourteen months from the commencement of their testing-period.

The strong inheritance of Tiki, the dam of our New Zealand champion, is further evidenced on her sire's side. Starlight II, the recipient of many show awards, was the sire of Tiki. Starlight II and Sabean III were full brother and sister, and, although their hereditary factors may not have been the same, a breeder's appreciation of Starlight II would be much enhanced by the splendid C.O.R. of Sabean III, which has a credit of 625·38 lb. fat at the age of seven years. The dam of Starlight II is Sabean II. This cow, commencing at almost ten years of age and under conditions which represent no forcing, produced 454·67 lb. fat.

Mere's sire is Fancy's Lord Twylish, an importation from the herd of Mr. Chirnside, of New South Wales. The record of Mere has brought the name of Fancy's Lord Twylish into the limelight, and we trust he will add to Mere's class other daughters with equal production.

During the latter part of August twenty-five varieties of tomatoes were sown in the glasshouse at Ruakura, and all germinated well. While germination in the main took eight days, it was found that by placing panes of glass on some of the boxes it was possible to gain at least four days from date of sowing to time of pricking off. This is a point worth noting, and, says the Horticultural Overseer, the method might be tried on many other of the finer seeds.

SCIENTIFIC NATIONAL FORESTRY FOR NEW ZEALAND.

D. E. HUTCHINS, F.R.G.S.*

IT has been thought that the forest-trees of New Zealand grew too slowly to be economically preserved, and that their place should be taken by forest plantations of exotic timbers, and by timber imported from Australia or, at even greater expense, from the other side of the world. It was considered that the wealth of the Dominion lay in sheep and cattle, and that the country should be developed with them. But while the essential importance of the country's pastoral industries is not gainsaid, there are other rural economic factors claiming active attention. The Dominion is now losing wealth and population, together with much of its beauty, by the indiscriminate destruction of the forests and non-development of the mountain lands as they have been developed in some of the best parts of Europe, North America, and Japan.

The forest question is the most important social question now before the country. It is common historical knowledge that every country which, during periods of national neglect, has lost its forests has had to set about restoring them at great expense afterwards. Spain, Portugal, Italy, and Greece, in the latitude of New Zealand, are now doing this. I have recently been on a forest tour through three of these countries, and have seen something of what they are doing.

It gives food for reflection that within a few miles of the capital of New Zealand, after seventy-six years of colonization, there is mountain forest land, pathless, waste, and returning nothing; while similar land in the Vosges and Black Forest is covered with a network of roads, the forest in one or other of its sections always yielding timber, and giving to the State a net return of £2 or £3 per acre per year (average yield over the whole area); the valleys dotted with pulp-mills and timber-mills; and hamlets sheltering the best manhood of the country.

*Mr. D. E. Hutchins, formerly of the Indian, Cape Colony, and other African Forest Services, has been in New Zealand during the past year at the invitation of the Government, for whom he is preparing a comprehensive report on the forests and forestry of the Dominion. The substance of the present article was given by Mr. Hutchins as an address at the inaugural meeting of the New Zealand Forestry League, held at Wellington, 11th July, 1916.—EDITOR.

With the clearing of the bush land to make way for settlement large areas of steep mountain land and poor soil have been denuded of forest, when it would have been better to have kept this ground as national or State forest and employed forest experts to advise regarding the treatment and improvement of the forest. The destruction of the forest in New Zealand has now reached to such a pitch that the welfare of the country is threatened, and the timber industry of the Dominion approaches extinction. The valuable kauri timber is nearly finished, and the Forest Commission of 1913 recommended that the last good kauri forest, the Waipoua, should be destroyed (excepting 200 acres). There is good evidence that the kauri timber burnt in the Puhipuhi Forest had a "worked-up" value of about £3,000,000. This figure represents many times the cost of a Forest Department for many years. There could have been no serious fire in the Puhipuhi Forest with a Forest Department and ordinary fire organization. As late as ten years ago it was reported that there was 160,000 acres of kauri forest still remaining "in its natural state." Kauri timber has almost exactly doubled in price during the last fifteen years; totara and black-pine for most classes show the same increase.

With the decline of the timber industry in New Zealand has come an increase of timber imports. In the ten years before the outbreak of war, while the population of New Zealand increased 26·5 per cent., timber imports rose from £161,236 in 1904 to £504,931 in 1913, or 313 per cent. ("Statistics of New Zealand" for 1913, p. 233). Thus New Zealand, when the war broke out, was paying at the rate of £1,383 per day for imported timber. At the same time there was an importation of £110,493 worth of furniture, £315,706 worth of paper (excluding the fine kinds not made from timber-pulp), and of bark and other tanning substances £37,576. The great bulk of such timber and the wattle-bark for tanning would come directly from the forests of New Zealand if those forests were put in order, while the prosperity of the furniture and paper industries depends primarily on an abundance of the raw material—timber. It is no argument to say that for the time being timber exports nearly balance imports. The loss of potential wealth and employment in New Zealand from the timber imports remains the same.

Besides these direct losses, New Zealand is suffering from the squandering of some of its most beautiful scenery with the destruction of the forest. With the destruction of the forest river-floods become more severe, and there is waste of good land near the river-beds. With the destruction of the forest erosion tends to tear the soil from the mountain-side and send it out to sea. With the destruction of the forest rivers lose their summer water—the Wanganui,

for instance. Rivers flooded in winter and low in summer are bad for trout. Grossman, in his pamphlet, "Evils of Deforestation," has a valuable chapter with some striking illustrations of the mischief caused by floods in New Zealand.

The protests that have been raised on every side against the ruin of the beautiful forest scenery of New Zealand have resulted in the formation of scenic reserves, which to be of much use would have to be large, and thus extremely costly by keeping so large an area of forest unproductive. As it is, those of them that may be considered permanent are small, and are but imperfectly protected against fires and cattle. There is no guarantee that, left as they now are, any of them will last. It is reported that during 1915 as much as 638 acres was revoked, as the forest had been destroyed. Up to that year a total of £80,751 had been spent on scenic reserves, chiefly in land purchase and surveys. There is a systematic inspection of the scenic reserves, which is excellent as far as it goes. But the inspecting officer has no executive authority: that lies practically with the Commissioners of Crown Lands, who may or may not take an interest in forestry. In any case they are not foresters, and their lands staff has other duties to attend to.

It is useless attempting to evade the main issue—national forestry. If we want to preserve forest (such as that on most of the scenic reserves) in contact with civilization, the usual machinery of a Forest Department must be employed. Either all the civilized world is wrong in this respect and New Zealand and England right, or *vice versa*. With an efficient system of national forestry there would be no difficulty in preserving absolutely untouched, and keeping in a state of nature, those forests that it was intended to preserve as "nature" reserves. This is done in parts of the suburban forests of Brussels, of Paris, in the Alps, and elsewhere in Europe, and on a much larger scale in America. With the usual machinery of forest-conservancy the protection of "nature" reserves becomes automatic, and their formation as easy as putting an extra train on a State railway.

Lastly, one of the great lessons of the present war is that a country cannot defend itself without a liberal supply of brushwood and timber. Guns have to be screened from observation, and trench-construction takes more timber than mining. The average for ordinary trenches along the French lines has been rather more than a cubic foot of cordwood per foot run of trench. An ordinary battery of guns takes about £240 worth of wood and timber to screen it, or in some places £100 worth for a single gun. Great quantities of wood and charcoal are required for camp cooking and heating.

A GOOD-SIZED KAURI IN MR. J. TROUNSON'S BUSH NEAR KAIHU, NORTHERN WAIROA.

Figures: Messrs. Trounson (left) and Hutchins (right).

FORESTRY IN SOUTH AFRICA.

In South Africa we see the forest cared for as in Europe. All the native forest under the Union Government is being carefully preserved, and most of it worked at a profit. There is a Forest Department, and a complete system of forestry which, while protecting the forests against fires and cattle, works off the old timber at a handsome profit, and ensures the gradual propagation of a better supply of timber in the future. This has been going on for the last thirty-three years. Valuable exotic timbers are introduced and left to spread naturally, as, in fact, does gorse, blackberry, and manuka now in the wasted forest areas of New Zealand.

The dense evergreen forest of South Africa closely resembles that of New Zealand. Some of the chief trees of each country are podocarps. Thus the two big timber-trees of South Africa are *Podocarpus elongata* and *Podocarpus Thunbergii*. They are called yellow-wood, and the largest of them grow up to diameters of 22 ft. These giant trees have the long, straight, cylindrical bole and the huge spreading crown of the kauri-trees of New Zealand. In New Zealand there is *Podocarpus spicatus* (black-pine), *Podocarpus ferruginea* (miro), *Podocarpus dacrydioides* (white-pine), and *Podocarpus totara*—in fact, all the chief timbers are podocarps except kauri, rimu, and puriri. Geologically, possibly, it was one forest at one time, and that geological time just the period required to differentiate the species.

The indigenous *Podocarpus* forest of South Africa is a small area in the South African Union, but the same forest, little modified, stretches up the eastern highlands of Africa to the Equator in British East Africa—altitude compensating latitude—and terminates, I understand, in Abyssinia. Thus the forest at sea-level in lat. 34° south is nearly the same as the forest at 8,000 ft. under the Equator. I can speak positively about this forest, because I spent twenty-six years as a forest officer in South Africa and four years as Chief Conservator of Forests in British East Africa. My surprise and delight may be imagined when I walked near Auckland into what looked like the same forest, and my horror at seeing this forest being recklessly destroyed because it was not fully realized that it could be worked and preserved (indeed, gradually improved) as in South Africa.

After nine months spent in New Zealand and an official tour to the various types of forest in each Island, this first impression has ripened into the certainty that nothing more than ordinary forest organization is required to work, and at the same time perpetuate and improve, the forests of New Zealand. On the whole, the forest of South Africa is less valuable than that of New Zealand, and

certain of the best trees grow some 50 per cent. more slowly. Compare, for instance, the totara figured in the report of the New Zealand Forest Commission of 1913 with the growth of stinkwood and white-pear reported in the last South African Forest Yearly Report.

There is nothing remarkable about the forest-work that is going on in South Africa; it is simply what is being done throughout the civilized world—all over Europe, North America, Japan, and more recently Chile, while within the last year or two the Argentine and even China have also taken the first steps in forestry. What is very remarkable is that a civilized country like New Zealand, with forestry naturally indicated as one of its chief industries, should as yet have not taken the first steps in scientific forestry.

FORESTRY AND THE COST OF LIVING.

The loss of the forest (apart from present war conditions) may be regarded as one of the chief causes of the rise in the cost of living in New Zealand. Timber for house-building, and abundant firewood, are prime necessaries of the household. But these have been banished to a distance from every town in New Zealand. It made no difference whether there was economical forest land near the town or not—down went the forest and up went the cost of living. At Brussels one steps out of one of the best streets (the Avenue Louise) into the Bois de la Cambre and the Forest of Soignes, which is the second-largest State forest of Belgium.

At Cape Town, where the coal-mines are at a distance as with Wellington, firewood is the poor man's fuel, coal the rich man's. It is cheaper in the suburbs of Cape Town to grow wattle and eucalypt firewood than to buy coal. I speak with the experience of a householder of twenty years' standing. I grew all the firing required for my household in the grounds round my house. A supply for a year's cooking and four months' warming fires is what is required at Cape Town.

Suppose the mountains near Wellington were under good forest conserved by the State, that would mean cheap house-building timber, cheap firewood, and considerable employment for the men tending the forest and working the timber and firewood—some twenty times the employment afforded by sheep-runs or cattle-walks. But often when the forest is destroyed the grassing fails wholly or in part, and then production ceases, and the area becomes a pathless waste of gorse, fern, bramble, and manuka scrub.

The French have a saying, "Tout revient à la forêt," referring to the value of the forest in providing man with so many of his

wants—housing, firing, grass, fodder, recreation-grounds, &c. The nearer the forest can economically be kept to a man's back door the lower the cost of living. England has destroyed its forests; it has little State forestry now, and pays out forty-three millions sterling a year for imported timber and forest produce. England loses, too, with the loss of its forests a great rural industry and the pick of its manhood. New Zealand cannot afford to follow this example. France, on the other hand, has nearly double the whole population of New Zealand employed in the care and working of French forests and in forest industries. Similarly, Germany has some four million people living directly and indirectly on its forests; otherwise, with its intense earth-hunger, it would not keep one-fourth of its area under forest.

Some of the war maps that have been published lately present a picture of forest in the most industrial part of Europe, which is a striking object-lesson. While New Zealand, as regards forestry, is now drifting into the condition of the old-time misgoverned countries of Europe—Spain, Portugal, Italy, and Greece—the war maps of France and Germany show that they, in their most advanced and industrial parts, have some 25 per cent. of their areas occupied by forest, which is dotted about the country among the fields, villages, and towns. I could give some interesting accounts of the extraordinary cheapness of living and the well-being of the people dwelling in the forest valleys of the Vosges and Black Forest.

GROWTH OF NEW ZEALAND TIMBER-TREES.

Forestry in New Zealand has been misjudged by the entirely erroneous idea that the New Zealand native timber-trees grow more slowly than the ordinary timber-trees of other countries. Statements to that effect are common, but they will not bear critical examination. I find that most of the timber-trees of New Zealand grow faster than the timber-trees of Europe and America—rimu and kauri, the two chief timbers, decidedly faster. As already mentioned, according to the last published returns, the New Zealand timber-trees grow some 50 per cent. faster than two of the chief native timber-trees of South Africa. It is the same story if we compare the growth of New Zealand trees with those of North America, as may be seen by reference to pages 363 to 367 of a recent work on American forestry by Professors Moon and Brown. Nearly all the American timbers grow rather slower than kauri and rimu, some much slower.

The mistake regarding the growth of New Zealand trees has arisen from two causes—(1.) Comparing trees such as kauri, rimu, and totara, trees of the dense evergreen forest, which generally

grow badly when taken out of the forest, with certain quick-growing exotic trees—*insignis* pine, eucalypts, and wattles—trees of the open forest, which grow well when planted in the open, and which have been picked for their rapid growth in countries with much larger forest floras than that of New Zealand. (2.) It has been assumed that the profitable cutting-maturity of New Zealand trees is that at which they are now felled. In the Forest Commission's Report of 1913 is given a somewhat striking figure of the cross-section of a totara-tree 8 ft. in diameter, and a diagram is added showing that, from a computation of the rings, it is 416 years old. The conclusion intended to be drawn is that it takes 416 years for a totara to mature. This is very misleading. Thus the Californian redwood in virgin forest lives from 1,300 to 1,750 years (Kent, in "Manual of Coniferæ"); but the most profitable cutting-age is somewhere about fifty to eighty years. Douglas fir, again, lives 450 to 750 years in virgin forest, while in English plantations it is cut at forty years.

There has been no scientific forestry in New Zealand, and no foresters to measure the actual production of timber per acre per year in the forest—surely a strange position in a forest country after seventy-six years of civilization! The indications, however, are pretty clear that the native New Zealand timber-trees grow, on an average, decidedly faster than the five chief timber-trees in the forests of Europe. Kauri has a somewhat better height-growth, and almost double the diameter-growth. In a normal dense forest the height-growth of kauri would be improved and the diameter-growth reduced. As it is, there is the remarkable fact that kauri with yearly rings nearly 1 in. wide is known (Cheeseman). I myself have seen kauri with ½ in. rings. In the common pine of Europe, Scotch pine (apart from deformity), no such broad rings would ever occur.

In the New Plymouth Botanic Gardens (Pukekura Park) is a good collection of all the best timber-trees of New Zealand. These have been planted, and their exact age is now known. The shade and moisture conditions are much like those in the native forest. These planted native trees are growing at an average rate of 2 ft. or 3 ft. per year in height, while some of them are growing faster. Thus a graceful birch-like ribbonwood-tree (*Plagianthus betulinus*) in front of the tea-house is 25 ft. high at six years of age. A prominent New Zealand mahogany-tree (*Dysoxylon spectabile*) has grown 4 ft. during the past summer. I saw a score or more young rimu-trees growing at the rate of 2 ft. or 3 ft. in height per year, and one thirty-year-old tree making shoots of 3 ft. per year. The imported trees, apart from *insignis* pine and one or two eucalypts and wattles,

grow no faster, says the curator. I saw an English oak and a puriri of the same age growing side by side, the puriri decidedly the larger tree. Two puriri-trees, seven years of age, average 18 ft. high. I saw a perfectly grown little kauri 18 ft. high at twelve

LARGE RIMU, NEAR LAKE IANTHE, WESTLAND.

This tree, on right of photograph, measures 5 ft. in diameter (above base bulge), and has a height of 195 ft. *[Photo by D. E. Hutchins.*

years of age. Elsewhere in New Plymouth is a healthy kauri-tree which at thirty years of age is 9 in. in diameter and 38 ft. high; and there, of course, kauri is too far south for its best growth. Nevertheless, according to the standard-yield tables, an average

Scotch pine in central Europe forests is only 3 in. to 4 in. diameter and 29 ft. high at the same age. Thus here, in a climate too cold for it, is kauri growing faster than the ordinary pine-tree of Europe.

At Dargaville (lat. 36°) Mr. Mitchelson showed me a kauri he had planted that at sixteen years from planting was 9 in. in diameter and 32 ft. high. Here is a kauri, in its own climate, with nearly double the growth of the New Plymouth tree, and far beyond all practical comparison with Scotch pine, for the normal for Scotch pine at sixteen years on average-quality soil is 1½ in. diameter and 13 ft. height.

In the Jubilee Park, Dunedin, are two beeches growing side by side, *Fagus fusca* (New Zealand) and *Fagus sylvatica* (Europe). They are the same age, but the New Zealand beech is distinctly larger.

A number of planted trees in the Auckland Domain were systematically measured and described in a paper read before the Auckland Institute in 1887. This showed that for the first twenty years the native trees averaged about 1 ft. in height-growth per year, and about ⅓ in. in diameter-growth per year. There the conditions are not so favourable as in the New Plymouth Botanic Gardens: the surroundings are less like the shade and shelter of the native forest, but the growth is still far above the European forest standard. Rimu and kauri, the two important timber-trees of New Zealand, grew the fastest; and at twenty years they averaged 8 in. diameter and 28 ft. high. A Scotch pine on soil of medium quality, in central Europe, at the same age will average 2 in. in diameter and 17 ft. in height (Schlich's "Manual of Forestry," Vol. iii, p. 343). Thus the standard European pine has little more than half the height-growth and exactly one-fourth the thickness of these rimu and kauri trees in the Auckland Domain at the same age.

An interesting list in the Forest Commission Report of 1913 (page 70) gives the following dimensions for various native trees at forty years of age: Kauri and rimu average 9 in. diameter and 50 ft. height; totara and white-pine average 11 in. diameter and 38 ft. height; miro and black-pine average 4½ in. diameter and 27 ft. height. Scotch pine at forty years averages 4½ in. diameter and 38 ft. height, according to the normal-yield tables. Thus at forty years kauri and rimu are far above Scotch pine both in height and diameter growth; totara and white-pine are above the diameter-growth and equal in height-growth; miro and black-pine are lower in height-growth and show the same diameter-growth.

Cheeseman has made elaborate investigations on the growth of kauri. His general result is 9·7 rings per inch of radius: Kirk's figure is 10. These results are about double the average of the five

common European timber-trees, on soil of average quality, cut at the best age for maximum growth; while the New Zealand trees are not measured at the best age for maximum growth.

It might be expected that kauri would grow faster than timber-trees of mid-Europe, because the latter are in a colder climate; but when we compare kauri with cluster-pine (*P. pinaster*), the common pine of southern Europe, we see that kauri is still the faster-growing tree. Thus at maturity at eighty years cluster-pine averages 11 in. diameter and 79 ft. height, or practically an average of 1 ft. height-growth and 14·4 rings of radius-growth, since $\frac{11}{80}$ = 0·1375 in. diameter-growth per year, or 7·2 rings per inch diameter and 14·4 radius (Normal-yield table, Forest of Leiria, Portugal: Brit. Assoc., 1914).

The economic cutting-size of kauri may lie between 9 in. and 3 ft. diameter. Seven of Cheeseman's kauri-trees come within these limits, and show an average of 8·2 rings per inch of radius (Trans. N.Z. Inst., June, 1914, p. 14). Thus we have rings of yearly growth per inch of radius as follows: General average of five chief European timber-trees, at usual felling-ages, 19 rings; cluster-pine, South Europe, Leiria Forest, 14·4 rings; kauri, seven of Cheeseman's trees, 9 in. to 3 ft. diameter, 8·2 rings. In this comparison we must not attach too much importance to the diameter-growth alone, because the European forest figures refer to normal, closely grown forest-trees, and these have less diameter-growth than trees in the open, and the kauri-trees are partially in the open; but the height-growth comparison is to the advantage of the European trees, since they have been drawn up by close growth, and the native trees in these examples have been only partially or not at all drawn up. In spite of this, the average height-growth of kauri is rather faster than the average of the five chief European timber-trees, while the diameter-growth is almost double.

In the course of a twelve-months residence in New Zealand I have measured some hundreds of yearly ring-growths on cut trees. With a few exceptions, and these not the most important trees, they all tell the same tale—an average growth rather faster than European trees and a good deal faster than South African native trees. Black-pine, the slowest grower among the large timber-trees of New Zealand, shows twenty-five rings per inch on Mr. Phillips Turner's specimens—that is, 12½ years per inch of diameter-growth. Scotch pine, at the various ages up to maturity, ranges between nine and ten rings per inch of diameter-growth.

Certain precautions have to be taken in counting the growth-rings. For the purposes of practical forestry we may discard the big old trees long past the cutting-age of economic forestry. These

always show very fine rings towards the bark, since the year's growth is spread round so large a periphery. Then, again, with the smaller trees of practical forestry the mean radius has to be taken, since, normally, every tree tends to have broad rings near the pith and narrow rings near the bark.

The rings of growth on New Zealand trees are not so clear as on European trees, but they are generally clear enough to be accurately counted with a little trouble. So far, the only rings that I have found not to be yearly are those of rewarewa (*Knightia excelsa*). The yearly character of all the other rings is judged from the appearance of the rings themselves, and from the check afforded by rings on planted trees of known age. The smallest rings that I have seen, on medium-sized logs, are fifty to an inch on the mean radius of a silver-pine (*Dacrydium Colensoi*); the largest, two rings to an inch on kauri.

This evidence with regard to the growth of native trees can be verified by any one without much trouble. The curator of the Botanical Gardens, New Plymouth, Mr. W. W. Smith, is courtesy itself to visitors. It is usually not difficult to count the rings on trees that have been cut in the forest. Schlich's "Manual of Forestry," with its normal-yield tables, is in the library of the New Zealand Institute and elsewhere at Wellington; also Spiedel's "Yield Curves" in my "Journal of a Forest Tour." Sir W. Schlich is the Professor of Forestry at Oxford University and the highest authority on scientific forestry in England. There are collections of timbers in some of the New Zealand museums, and in Mr. Phillips Turner's office at the Lands Department, Wellington, are various interesting samples of New Zealand timbers.

To have a quite accurate comparison of forest-tree growths one requires a forester's valuation survey of a fully stocked forest area, of known age, in a New Zealand forest. But as there have never been trained foresters in the Dominion to make such a valuation survey, I can only say that, as far as present data exist, kauri and rimu, the premier timbers of New Zealand, in a fully stocked New Zealand forest would show an average growth faster than any of the ordinary European forest timber-trees—Scotch pine, spruce, silver-fir, oak, and beech. Kauri is decidedly the best timber-tree in New Zealand. It seems to be equally certain that it is the fastest grower among the good timber-trees of the country.

In the report on New Zealand forestry which I am preparing for the New Zealand Government I give an abstract of the growth data of various New Zealand, European, and American trees. I cite Scotch pine here because it is of medium-rapid growth, and because it is the common house-building timber of Europe.

Photo by D. E. Hutchins.] DENSE STAND OF WHITE-PINE.
Cleaned patch at Ferguson's, Westland.

In all this we must be careful to remember that I am comparing the average growth of native trees in their forest homes in Europe, in America, and in New Zealand. It is quite another story comparing these closely grown forest-trees, which alone produce the best timber, with trees grown in the open or in sparse plantations. The production of timber per acre with either close-grown or sparse-grown trees will be about the same, but the production of timber per tree very different.

Then, too, we must remember that many trees taken out of the shade and shelter of their forest homes and planted in the open are nearly like fish out of water. That is the tendency with the native trees of New Zealand: taken out of their sheltered homes they tend to grow badly or to die. Kauri and totara are the least sensitive in this way.

For commercial purposes none of the South African trees grow fast enough to repay the cost of planting; but when Nature gives us forests of them it will pay to maintain those forests. That is quite a common case with many of the best trees — jarrah, for instance. No one has yet succeeded in making profitable plantations of jarrah.

Naturally, taking the world through, for planting purposes trees picked for their quick growth are to be preferred to either the ordinary forest-trees of Europe, of America, or of New Zealand. It does not follow that rapidly grown trees must necessarily produce inferior timber. Closely grown *insignis* pine produces a fine-grained timber, and the production of timber per acre is quite remarkable.

In Europe the planting of exotics hardly enters, as yet, into practical forestry, though they have been under trial for well over a hundred years. It is certain that for practical forestry in New Zealand the first and most important thing is to care for and improve the native forest, exactly as the native forest has been cared for and improved in Europe, or, to come nearer home, as the forest in South Africa, so like that of New Zealand, is being cared for and improved.

The fact is there has been an unaccountable belittling of the native trees of New Zealand, their value and their growth. To give an instance: All the books on the subject state that white-pine is the tallest of the native trees, and that it does not grow higher than 150 ft. I had not been a week in the West Coast forests before I measured a white-pine (with a verified angular instrument) which was 210 ft. high; and Mr. Phillips Turner has measured with a theodolite and surveyor's chain another white-pine nearly as high. Near Lake Ianthe I measured a rimu 5 ft. in diameter (above the base bulge) and 195 ft. high. No doubt there

are higher trees than these; I believe I saw higher trees, but the forest was too dense for me to measure them.

QUALITY AND "STAND" OF NEW ZEALAND TIMBER.

In the quality of their timber the native trees of New Zealand seem to equal those of Europe. Kauri for indoor work and totara for outdoor work compare with oak. Rimu for ordinary house-building is better than Scotch pine. White-pine compares with spruce and silver-fir generally, but is better for butter-boxes. The timber of the New Zealand beeches seems much like that of the European beech, but the red or *fusca* New Zealand beech is decidedly better. The defective forestry of New Zealand has undoubtedly depreciated the value of the native timbers in allowing them to be felled out of season and used while the timber was still quite wet. Kauri ranks high on the English timber-market; pre-war prices were 4s. per cubic foot for kauri, against 3s. for such valuable timbers as black-walnut and pencil-cedar—in fact, there is no ordinary good timber that fetches a higher price than kauri on the English market. It is the same with kauri on the Australian market. But when one gets to New Zealand it is one of the saddest stories in the colonial history of the British Empire to learn how these valuable kauri-trees have been destroyed—destroyed, too, for no reason, for the kauri forest might just as well have been milled and preserved as milled and destroyed. All the good kauri land might have had the forest milled and cleared for settlers; but the bulk of the kauri forest which is on poor soil should have been demarcated into the national forest area of New Zealand. But, alas, there has been no discrimination, no forest demarcation—simply a reckless destruction in ignorance of the forestry methods of other countries.

None of the trees planted in the Government forest plantations have the same value as kauri, with the exception perhaps of Californian redwood, and that has been little planted; while of the little planted a proportion has been lost through faulty forestry—a wrong mixture in the planting.

Satisfactory as are the growth and value of the native trees, it must be remembered that their growth, in quantity and quality, in the wild unimproved forest, is being reduced by their being for a time dominated by other trees. Too much or too little growing-space will equally spoil a timber-tree. This loss of growth is shown on the cross-sections of most New Zealand trees that I have examined, and crookedness is a common fault in New Zealand timber. These faults will be remedied in the more regular cultivated forests of the future. The chief fault, however, in the New Zealand

forest of to-day is not slowness of growth, or bad quality in the timber, but a low "stand" of timber. The last official forest report quotes 15,000 superficial feet (1,250 cubic feet) as the average yield of sawn timber per acre of millable forest (Lands Department Report on State Nurseries, 1916). Very curiously, Captain Campbell Walker, the Indian forester, quoted exactly the same figure forty years ago (Trans. N.Z. Inst., 1876), the two computations being made quite independently. For good kauri forest Kirk quotes an average stand of about 2,000 cubic feet milled. This with more conservative working would probably represent a stand of about 3,000 cubic feet in Europe.

These New Zealand stands may be compared with 4,000 cubic feet (the usual figure for Scotch pine in Scotland), cutting at age eighty years, or central Europe, 5,340 cubic feet, cutting at 110 years. But the stand in the wild forest is generally low. Thus good forest on the Appalachians (latitude and climate of New Zealand) in North America has an average stand of 1,400 cubic feet only.

Thus the real fault in the New Zealand forest of to-day, the low "stand," is remediable by good forestry, of which the chief points would be a very careful marking of fellable timber so as to ensure the best natural regeneration, and a liberal expenditure on such cultural operations as the condition of the forest demanded—ring-barking or thinning to let in light, and seed-sowing, planting, or seedling transference in too open areas.

CLASSES OF FOREST.

In most countries we see three classes of forests—(1) The wild virgin forest, with trees sometimes very good (but in South Africa and New Zealand only good in patches), and stocked with much timber that is badly shaped, overmature, and unsound; (2) the cultivated forest, the common forest of most of Europe; (3) forest plantations.

The cultivated forest is produced by modern forestry science, mainly by regulating the cuttings. Almost always the forest regenerates itself, and, as a whole, is continuous in its growth and reproduction. To any one but a forester this forest looks exactly like the wild forest, except that it is somewhat more regular, with a better stand of timber. This class of forest, towards which all the forests of the civilized world are tending, has been entirely lost sight of in New Zealand, and this is the fundamental mistake that has been made in the forest policy of the country.

It has been assumed that plantations of exotic trees can replace the native forests, but that is a rather risky and certainly a costly assumption. There is always risk in planting exotic trees, and if New Zealand had to be supplied with timber grown entirely in

forest plantations the cost would be enormous. Thus Victoria has some 4,000,000 acres of demarcated forest reserves, a small area according to European standards. To replant this area, taking actual South African figures of cost, would entail an expenditure of about sixty millions sterling, or 240 millions allowing interest at 4 per cent. up to a mean cutting-period of forty years.

This is not to say that forest plantations are unnecessary in New Zealand, though they are not so absolutely essential as in South Africa. To-day New Zealand requires large areas of the quickly growing *insignis* pine for packing-case timber, &c. This can be produced in twelve to sixteen years. It will supply a great want, and certainly give a good return on the outlay. Good *insignis* pine boxes have been produced for some years in South Australia. They sell there on the open market at a slightly higher price than the boxes made of imported pine.

Eucalypt plantations of ironbark, blackbutt, and tallow-wood, and the same trees introduced to the kauri forests in the North and spreading self-sown, are even more urgently required for railway purposes. There is little really good sleeper-timber in New Zealand forests. Tallow-wood and blackbutt grow faster than any New Zealand trees, and the best of the ironbarks certainly faster at first.

My personal leanings are in favour of exotics. I have been for the best years of my life planting them in South Africa. I should introduce self-spreading, valuable exotic timbers everywhere in the New Zealand forests, except in the scenic reserves preserved as parks for the native flora. It is sad to think that seventy-six years have been allowed to elapse in the history of civilization in New Zealand without introducing the quick-spreading exotic timbers, especially in such forests as those of the beech, where the stand of timber is low in quantity and quality; and this neglect is the more regrettable because these forests have a clean forest soil, so favourable for the purpose. When I first saw these neglected beech forests I had the vision of an unopened diamond-mine. So small a portion of the £40,000 now being spent yearly on forestry would have sufficed for the introduction of self-spreading exotics seventy-six years ago! Then there is the lesson of their growth to be learnt, the quality of timber they may produce under given conditions, their natural regeneration, and so on. This is all precious to the foresters of the future. It is a duty owed to posterity.

NEW ZEALAND FOREST PLANTATIONS.

The forest plantations that have been made by the Government in open country are the redeeming feature in all the story of forest waste and destruction in New Zealand. The growth of the

plantation trees, especially at Rotorua, is often magnificent. After the kauri-trees and the beech forests, nothing that I have seen in New Zealand has pleased me so much as the Rotorua plantations. For their age there are no finer timber plantations in the Southern Hemisphere. South Africa has not got an individual plantation of the same age which makes so good a show. The Australian plantations, at Whyte Park in South Australia, and at Macedon in Victoria, are sparse-planted and designed only to produce coarse timber. The Chilian plantations of *insignis* pine are not, I understand, equal in extent to those at Rotorua. There has been equally good planting in the South Island on a smaller scale.

The managers of the New Zealand Government timber plantations (curiously styled "Superintending Nurserymen") deserve well of the country. They have achieved a great measure of success in spite of a shockingly bad system of organization, a system so bad that if they had failed entirely no blame of any sort could have been imputed to them. There have been no working plans and no real technical direction. It is owing to the excellence of the local staffs and the careful management of the Lands Department that such a makeshift system has not broken down entirely.

Naturally, with a staff whose technical knowledge of forestry did not extend beyond nursery-work, mistakes became evident as soon as the trees began to grow. This is not the place to describe the mistakes, but it is necessary to refer to them because the failures that have occurred have been thought to be inevitable, and that is far from being the case. "What is the use of making plantations to be burnt?" has been asked over and over again. As a matter of fact, the forest plantations should be as safe as a house where there is a fire brigade. As it is, there has been serious loss from fire, except at Rotorua.

Sometimes, too, wrong trees have been planted, in the wrong place and in the wrong manner, as in the (fortunately small) plantations near Blenheim and Whangarei, where there has been serious failure. Actually nineteen years elapsed before, apparently, any one thought of planting any quantity of the tree that should have been first planted, the *insignis* pine. Millions of useless trees were planted, such as catalpa, and the "bois blancs" of France, weeds of the forest. Often the kind of trees planted depended on what tree-seed could be picked up at short notice from the nursery trade of Wellington. There is no Government seed-store as in South Africa. Instead of getting Scotch-pine seed from Spain, where there are superb forests and in the exact climate of New Zealand, seed was obtained from England, then from Sweden, and now seed from Finland is being tried.

RED-BEECH (FAGUS FUSCA) FOREST, PARADISE, NEAR HEAD OF LAKE WAKATIPU.

The tree behind figure is 34 in. diameter by 121 ft. in height.

Photo by D. E. Hutchins.]

The plantations were not laid out on a definite plan, so that they were exposed to fire from the first. There have been serious losses from fire, and two of the smaller plantations have been practically burnt out. Foresters are very careful about mixing forest-planting till they can see their way quite clearly. In the New Zealand Government plantations the same caution has not always been shown, so that some of the best trees—Californian redwood, Douglas fir, &c.—have not been able to develop.

Most, if not all, of these mistakes were pointed out by the Forestry Commission of 1913, and its report can be easily referred to for details. It did not require a knowledge of forestry to see them. Others have been since remedied by the Lands Department, to whom every credit is due for the good work that is now being done. The Lands Department was in no way responsible for the appointment or the mistakes of the late Chief Forester (deceased), of whom one hears nothing but praise, but who had the misfortune to be placed in charge of technical work with no means of acquiring a practical knowledge of it (see the interesting brochure issued by the Lands Department in 1914, at page 11).

The war broke out soon after the report of the Forest Commission was made, so that the fundamental error of having so considerable a forest expenditure without a skilled technically trained forester in charge still remains. There is still in New Zealand no responsible Forest Department as in other civilized countries. There is not at present a fully trained forester in the Civil Service of the Dominion; not a man who could go into the wild forest and draw up a technical working plan, mark a *coupe*, or make a valuation survey, nor in a regular forest rightly estimate the value of thinnings or final cuttings at different ages of maturity.

In the plantations will soon come the all-important question of thinning. The sylviculture of thinning is a technical subject. It cannot be learnt from books alone. The tendency in New Zealand will be to follow English text-books and overthin. That has already begun in the Government forest plantations. Not enough allowance has been made for the difference in the light-intensity of British and New Zealand latitudes, the sun of England and the sun of Spain. Australia has cut the knot by having only wide planting and coarse timber. The New Zealand plantations are close-planted, and should produce fine-grained timber with skilful thinning.

Much is to be learnt from travel, but a good knowledge of sylviculture requires long study under a master. Mr. R. G. Robinson, who has charge of the forestry of the South Island, was sent on a useful forest tour, but the war unfortunately cut it short as he approached Spanish latitudes.

It is worth noting that our good friends the Russians, who are steadily getting into order their huge areas of wild forest, had, when the war broke out, no less than eight hundred trained foresters doing "working plans." By "trained foresters" I mean university men, ranking in their scientific training with medical men and scientific agriculturists in New Zealand.

The success that has been achieved in the forest plantations, particularly the fine plantations at Rotorua, makes it quite clear that with ordinary business precautions forest-planting in New Zealand is a State necessity of the first importance. Besides the special planting of *insignis* pine and poplar to replace white-pine for box and case timber, plantations of fir, poplar, &c., for paper-pulp, and special eucalypt (ironbark, &c.) plantations for railway purposes in the North, much planting will be required to put the native forest in order and to introduce the valuable self-spreading timber-trees, such as silver-fir, spruce, Douglas (Oregon), *Thuya plicata*, *Tsuga Mertensiana*, *Cupressus Lawsoniana*, &c., which are some of the picked timber-trees of the world in these latitudes. They are the trees that are looked forward to for the "new forestry" of England. They are mostly already growing well in England, and may be expected to do equally as well in the New Zealand native forest, since they are shade-bearers in temperament, and grow naturally under conditions similar to those of the New Zealand bush. They also spring up self-sown amongst scrub, gorse, and fern.

I may cite one case in point: *Thuya plicata*, the western red-cedar of America, is coming up like a weed in the grounds of one of the old houses at Hokitika. It is a tree that delights in the swamps and wet of the West Coast forests of the South Island. Amongst the fine collection of coniferous timber-trees on the Pacific slope it is one of the best. Its timber is very durable, soft, and easily worked. It represents about one-third of the forest resources of British Columbia. It attains magnificent proportions: trees 16 ft. in diameter and 200 ft. high have been found. The seeds are very small and light, and travel far, and it is an abundant seed-bearer. It is described as growing best in America in moist places, such as beds of moss or on decaying logs and stumps in regions of heavy rainfall. The seedlings have a remarkable power of thriving in dense shade. Naturally they cannot grow much under these conditions, but they do not die, and when the forest is opened out they shoot up. The average growth is reported as exactly the same as New Zealand kauri.

For the planting of such trees in the native forests of New Zealand small "bush" nurseries require to be made; and the self-spreading timber-trees can be introduced by ring-barking and planting in strips.

No other cultivation would be required, the weeds being kept down by "cut and mulch" (see my "Australian Forestry"). Last year half a million blackwood-trees were planted in this way in the native forest in South Africa.

For the more open classes of New Zealand forest there is the introduction of well-selected eucalypts and wattles. The self-spreading qualities of these are well known.

Lastly, planting will have to be resorted to in the wild forest wherever natural regeneration fails. Foresters will make it the business of their lives to study the natural regeneration of the best native timber-trees, and to mark their *coupes* or felling-areas in the interest both of the sawmillers and natural regeneration; but the latter must sometimes fail, and then there will be nothing left but planting. We must remember that every native bush left unworked and unimproved is an idle capital returning no interest, and in this sense a national loss. We can only get it milled gradually as the country is developed, but the self-spreading valuable timber-trees of other countries may be got in at once. This is a big planting proposition. It will mean steady work extending over years.

Thus, to get the wild forest into order as profitable national estates much planting is necessary. The doubtful financial position of the present plantations is only what had to be expected, since the work has been done without the usual skilled direction. This is easily remediable; and it must be remembered that even although there may be loss on the first crop of trees in the present timber plantations, if natural regeneration can be managed there will be gain on the second and subsequent crops. And, further, it is quite possible that under skilled direction for future plantations, with a better selection of planting-sites, and the rapid increase in the value of timber in New Zealand, Government timber-planting (apart from that in the native forests) may give profitable returns, rivalling the returns from the improved native forests.

And when all is said and done, even although timber plantations (outside the "bush") may not be remunerative for many years, the State reaps indirect advantages which in a national sense will compensate loss. That is the general position in South Africa. Some of the plantations there will never return interest on their cost; but there are national grounds for their formation which outweigh other considerations—exactly as the Germans deliberately maintain their Spessart oaks, cut at a regular rotation of three hundred years. This is done because the Spessart oaks support certain important industries; and if South Africa never gets interest on certain plantations it has the satisfaction of knowing that timber representing the greater part of the one and a quarter millions sterling going yearly

out of the country for imported timber is now being produced in South Africa.

And that is the main issue for New Zealand. Is it to lose half a million yearly (soon to be one million) or keep that half-million in the Dominion? If the natural forest had been demarcated fifty years ago, comparatively little forest-planting would have been required in New Zealand. But that was not done, and it is of no use now crying over spilt milk. The deficiency of natural forest must be made up with forest-planting, and the sooner that is done the better for the finances and industries of the Dominion, and, it may be added, the better for the development and settlement of the farm lands adjoining the boundaries of the demarcated forests, since roads and development of the forests render farming more productive and the conditions of living more attractive.

FIRE.

Fire is the bugbear of amateur forestry. It has been thought to be an obstacle to forestry in New Zealand. Actually, in no country that I know of is fire-protection easier. In New Zealand forests there is nothing like the danger from fire that exists in Australia, in South Africa, or in the southern pine forests of Europe. Of course there must be some organization, even in a country where the work is so easy as in New Zealand. As already mentioned, two of the forest plantations have been nearly burnt out, and there was a very dangerous fire at Hanmer shortly before my recent visit there. But with ordinary organization plantations in the damp climate of New Zealand would run little risk. Most of the native forest in its natural state will rarely burn, and here again only ordinary precautions are necessary to keep it free from any fire danger when it is being worked. In the forest plantations of New Zealand a few years good management now would go far towards repairing the mistakes of the past and endowing the country with valuable forest estates, but a more complete organization against fire is a first necessity.

(To be continued.)

The drawings of the small sheep-handling plant published in last month's *Journal* were after plans designed by Mr. H. Munro, Inspector of Stock, Wellington, for use at the Somes Island Quarantine-station, where a small flock of sheep is run by the Department of Agriculture. In connection with the plans as printed, the scale is given as 10 ft. to 1 in. This applied to the larger original drawing, and was inadvertently retained when the plan was photographically reduced to the size of the *Journal* page. As, however, all the measurements of the various parts of the plant are given on the plan, the matter of scale may be ignored.

WORK FOR THE COMING MONTH.

THE ORCHARD.

J. A. CAMPBELL, Assistant Director, Horticulture Division.

THE month of November marks the opening of the summer work in the orchard. To what extent this work is to be comparatively simple and plain sailing depends to a large extent on two things —firstly, the thoroughness with which the winter and early spring work has been attended to, and, secondly, the climatic conditions obtaining.

Sucking-insects, such as red mite, woolly aphis, mussel and San Jose scale, &c., appear very early in the season. Mussel scale hatch out and are on the move during the latter part of October and November. Red mite and San Jose scale in many instances commence activities with the spring of the blossoms, and increase rapidly in numbers through the summer. If left unchecked they seriously affect the health of the tree and consequently the fruit crop. The winter application of insecticides such as oil emulsion, &c., previously recommended, reduces the extent of summer affection and consequently the amount of summer spraying required in respect to the insects mentioned, according to the thoroughness with which it has been applied. It must be remembered that the summer is not the time to undertake the eradication of such pests. Summer treatment at best is only a check, but in most instances it becomes a necessary work in order to minimize the damage which otherwise would result.

The control of fungus diseases and the amount of work required during the early summer also depends very largely upon the late winter and early spring spraying. Under any circumstances such fungus diseases as black-spot, brown-rot, &c., are liable to cause trouble if the weather during the early summer is moist and muggy, but even under such conditions the danger is increased or otherwise according to the circumstances governing the earlier sprayings.

CONTROL OF DISEASES.

Codlin-moth.

Calyx-spraying to be of any value for the control of moth must be done before the calyx closes. The object of this spray is not to prevent the immediate affection of the fruit, but for the

purpose of secreting a small amount of poison within the eye of the apple, to be held there by the closing of the calyx to guard against the entry of the grub at this point later in the season.

Only under exceptional circumstances is the codlin-moth active in the orchard before the end of the second week in November. Therefore, when the earlier sprayings are not applied before the calyx closes — and this period is now past — the spray becomes practically wasted material if applied before the 10th or 12th November. From this time onward, however, spraying should be regularly and thoroughly done. The period between sprayings should not be more than three to four weeks, the former interval being in every way preferable.

It is well known that many orchardists spray much less frequently than this. Four, five, or even six weeks' interval between sprayings is not uncommon, but in all such cases the loss of fruit is very much greater than would pay for the additional applications. Not only does this loss apply to grubby and moth-blemished fruit, but also to fruit blemished by the leaf-roller caterpillar, which in some districts during the past season or two has become a more serious menace than the codlin-moth. For the control of moth spray with arsenate of lead at the rate of 1½ lb. to 2 lb. (paste) or 1 lb. to 1¼ lb. (powder) to 50 gallons of water.

Leaf-roller Caterpillar.

As far as all practical purposes are concerned the life-history of this pest resembles that of the codlin-moth, with three important exceptions. (1.) The young grub is not entirely dependent on the fruit for food, but secures nourishment also from the foliage, and may be therefore more or less grown, and consequently more difficult to kill, where it attacks the fruit. (2.) The chrysalis stage is passed between leaves rolled or sealed together for protection, and also in the stem end of the fruit. In regard to the latter condition, fruit is often wrapped with the chrysalis still in the stem-cavity. The rolling of the leaves and the sealing of the leaf to the side of an apple not only affords protection for the chrysalis, but also protects the grubs in different stages of development from the effects of the spray. (3.) Unlike the codlin grub, the leaf-roller caterpillar does not necessarily confine its attention to single fruit, but may pass on from one to another, blemishing several. Therefore fruit unblemished when packed may open up considerably damaged through a few grubs being packed within the case.

The ability of the grub to survive on the foliage would at first glance appear to afford it little advantage, as the foliage as well as the fruit of a sprayed tree is more or less coated with

the material. At the same time, apart from the fact that there is considerably more foliage than fruit on a tree, and therefore a greater percentage apt to be missed, it must be remembered that in the case of the apple the spraying of the foliage is incidental to spraying the fruit, and so long as the fruit is covered no special care is given to the foliage unless there is a special object in view. The result, no doubt, is that sufficient food is provided in this way by the new foliage that is constantly being produced by the tree to sustain quite a large number of grubs, which later, when their strength increases and the strength of the spray decreases, may attack the fruit with impunity.

The means of reducing possible damage by the leaf-roller to a minimum necessitates frequent spraying with arsenate of lead, as recommended for the control of codlin-moth, taking care to cover the foliage as well as the fruit of the tree with the material.

Black-spot.

For the control of black-spot combine lime-sulphur with the arsenate of lead when spraying for moth. Should the weather during the month be favourable to the spread of fungus diseases, extra care will require to be taken to guard against outbreaks by taking advantage of any brief spells of suitable weather for spraying. Should the disease break out and the fruit become at all badly affected, it may be necessary to resort to 3-4-40 Bordeaux mixture as a means of checking its further spread; but this should be avoided if possible, owing to the russeting effect this spray has upon the fruit.

Brown-rot.

This disease usually attacks the fruit just prior to ripening, hence the name of "ripe-rot," by which the disease is also known. But its attacks are by no means confined to this period; if the weather is at all wet and favourable, stone-fruits very often become affected shortly after they are set. Brown-rot affects both pip and stone fruits, but is particularly destructive in regard to the latter. Thinning has a very beneficial effect, and for this reason alone should be carried out in districts affected with the disease. As soon as the disease is noticed all affected fruit should be picked off and destroyed, and the tree sprayed with a weak solution of Bordeaux mixture, or lime-sulphur 1–100 to 1–125.

Powdery Mildew, Mussel Scale, and Red Mite.

For powdery mildew remove all affected parts, and spray with lime-sulphur combined with arsenate of lead when spraying for moth. This will also prove satisfactory in keeping in check red

mite, and will destroy the unprotected mussel scale. Strength of lime-sulphur 1–80 to 1–100.

DISBUDDING.

The formation of young trees can be greatly assisted by the rubbing-off or removal of undesirable wood-growths. This work pays very well for a little attention, and the earlier it is commenced the greater will be the advantage gained by the permanent branches through the operation.

CULTIVATION.

An abundance of rain has fallen throughout New Zealand during the last few months. This should prove very beneficial generally, but particularly so to several districts which have suffered more or less from a limited rainfall for some considerable time. The subsoil has been well saturated, and where good drainage exists the surplus water has drained away. Such conditions are favourable to a good season, for without an adequate supply of moisture the best of soils become of little or no use. All that is required now is to cultivate the orchard in such a way as to maintain the fullest advantage of the present conditions. To do this the surface of the soil should be thoroughly worked up with the cultivator as soon as it is in a fit state, otherwise the surface will bake and crack and the loss of moisture will commence. The operation should be repeated every few weeks throughout the summer. Should this be done it will be found that fruit-trees will remain healthy and thrifty with little or no rain for the remainder of the season.

THE POULTRY-RUN.

F. C. BROWN, Chief Poultry Instructor.

THE end of October or early in November should see this season's full complement of chicks hatched out—that is, if they are to grow to the desired size and produce the maximum profit over the cost of production. One of the chief weaknesses in poultry-keeping to-day is the postponing of hatching operations until the hot summer weather. It is a recognized fact that late-hatched stock are not only unsatisfactory from an egg-producing viewpoint, but are usually more prone to disease than the birds hatched out at the right time. Of course, where the majority of the hens in

the flock are three or four years old, and the hatching of the young stock has been delayed owing to the inability to secure the necessary number of broody hens, it will certainly be wise to hatch out sufficient chicks to replace next autumn the old birds that have passed their profitable period of production. Where the hatching-period is to be extended the stock will never prove satisfactory unless they are given clean fresh ground to run on, and provided with ample shade and shelter. Naturally, good feeding, a regular supply of green stuff, grit, and clean water are also essential.

Where ducks are kept, these can be hatched out much later, as they come to maturity earlier than chickens, and therefore have not the cold autumn snaps to contend against before they are developed.

MANAGEMENT OF GROWING STOCK.

The common practice of putting young stock direct from the brooder into a house where no special provision is made for hardening them off by degrees is responsible for heavy losses each season. Whenever it can be managed the birds should be kept in the same brooder without heat for several days before removal. The age at which they should be transferred depends largely upon the weather conditions. As a general rule, if they have been hardened off gradually in the brooder they can be removed with safety when from six to seven weeks old. It is important that suitable sleeping-quarters be provided for them in the colony houses, or they are very liable to get a set-back. If after being accustomed during the brooder stage to nestle under the hover in darkness and seclusion (as a family) they are placed in an open house, they will huddle together at night, each pushing and scrambling for an inside position. This is not necessarily because they require more warmth, but on account of their instinctive habit of choosing a secluded sleeping-place. If this huddling is allowed, the chickens will get into a sweated condition, and trouble is sure to follow. A darkened yet airy sleeping-place where they will settle down in comfort for the night should always be provided. All that is necessary is a light wood frame covered with scrim or one thickness of sacking, which should hang down to within 2 in. of the floor and be cut into strips similar to the draping of a brooder-hover. The frame may be made to stand on legs or be suspended by wires from the roof. Whichever method be used it should be arranged for easy removal, as the more often the hover is placed in the sunshine the better for the health of the chickens. If difficulty is experienced during the first night in getting the chicks to remain under the hover, temporary boards may be placed at

the side of the frame to keep them under. As a rule, after the second night the boards will not be needed. The corners of the house should be well rounded off with fine-mesh wire netting, so that in the event of the chickens crowding into them the ones at the back may obtain fresh air. The floor under the hover should be perfectly dry and well bedded down with thoroughly dry hay, straw, pine-needles, or chaff.

If once the chickens are allowed by improper management to huddle and become sweated it takes a long time for them to recover, apart from making them very susceptible to any passing ailment. It is next to useless taking every care of chickens up to this age and then placing them at such a disadvantage. A fact that should be borne in mind is that the heavy-laying pullet commences her business when about six months old, and to do this and prove a long-season layer she must be well cared for from the very shell.

To make sure of distinguishing different strains and ages the chicks should be marked in the web of the foot with a punch which is made for the purpose, and is obtainable for about 2s. 6d.

A BROODER TROUBLE.

Probably the most serious trouble which affects chickens after being removed from the heated brooder and when from six to eight weeks old is an inflammation of the veins. Its first symptom is shown in the hock-joints, which become green in colour. A gangrenous swelling follows. In a few days the wings become affected in a similar manner, and later the neck and head swell. As a general rule, when the trouble reaches this stage death is not far off. It is usually caused by overcrowding, damp quarters, and insufficient ventilation, while it is sometimes brought about by using damp bedding, which heats and brings on a sweated condition. Like most chicken troubles, there is no cure for this one. The remedy is merely a question of prevention, the chief essentials of which are avoidance of overcrowding, provision of ample ventilation under the hover, keeping the quarters clean and dry, and moving everything that tends to create a moist atmosphere.

TABLE POULTRY.

Those breeders who have hatched a large number of chicks this season will find it profitable to give the cockerels the very best of attention. At the present time the demand for high-class or even medium-quality table poultry is far from being met, and exceptionally high prices are ruling. There is probably a greater

scarcity of all lines of table poultry in New Zealand to-day than has been the case for many years, and the consumer must be paying record prices. Good dressed hens are being retailed at 10s., cockerels 12s. to 14s., and ducks 10s. to 12s. per pair, while choice turkey gobblers are in short supply at 1s. 10d. per pound. These prices are sufficient to indicate that the somewhat despised table branch of the industry is well worth catering for. As it is to be anticipated that the demand will continue to grow towards the Christmas season, poultry-keepers will be well advised to turn their attention to this section of the business, especially as they need not fear competition from outside sources as is the case with eggs. There is also considerably less poultry in cool storage this year than there has been in the past.

To cater for the high-class trade the poulterer requires something more than birds in merely store condition. Great improvement is needed in the manner in which the majority of table birds reach the market. The production of eggs is, and rightly should be, the chief aim of the poultryman, but unless he pays proper attention to the marketing of his surplus stock he cannot expect to obtain prices that will pay him for raising them. On the majority of plants the cockerels make good development prior to separation of the sexes, but it is too often the case that after the drafting takes place they get a severe set-back by reason of the poor feeding to which they are subjected. If any profit is to be made out of the cockerels they must receive the same care and attention as the pullets, though, of course, they require less range and different kind of food from the latter. Many of the poulterers are prepared to buy by the pound, provided they are supplied with proper-conditioned birds. Therefore it should not be forgotten that every ounce of flesh put on increases the profit made by the producer. It is gratifying to note that the custom of buying table birds by weight is becoming established and has been fairly general in Wellington for some years.

Table cockerels should be marketed when about four and a half months old. If allowed to go beyond this stage they commence to produce their second feathers and will lose weight instead of gaining it. It is generally the case that more money will be realized for a bird at four to four and a half months old than will be obtained for it at any time later on. It should be remembered that one fatted bird is worth more than two unfatted, and it costs more to produce a frame than to put flesh upon it. Readers should carefully study the results of the feeding-test with table poultry recently conducted by the Department and published in the July issue of the *Journal*.

THINGS TO REMEMBER.

Some people advocate that poultry-keeping should be recommended only as a sole means of livelihood and not as a side-line. The knowledge is certainly now available of how to manage poultry profitably on a large scale, but to apply this knowledge it is essential that it be first tested in practice, and it is certainly not advisable to do this on a large scale. Gaining experience in a small way and extending the plant as the knowledge increases is the only safe course.

It may be taken as a good guide that the thinnest birds at this time of the year are the heaviest layers in the flock. This does away with the fallacy that the good laying-bird can be overfed.

The hatching-qualities of eggs are often affected in transit; therefore do not always blame the breeder. It is not fair to judge results between eggs that have travelled and those that have not.

Do not overforce the pullet by means of stimulating foods. Remember that too early maturity is undesirable, even with White Leghorns. They should not commence to lay until six months old.

As soon as the sex can be determined the cockerels should be separated from the pullets.

No profit can be made from a cockerel sold as a table bird that is neglected in any way or is kept on a lean diet.

Cockerels that are undergoing the fattening process should be confined in small runs.

Now is the time that vermin multiply in abundance. Cleanliness, repeated sprayings, and good dust-baths are necessary.

Shelter from wind and shade from sun are necessary for good health of the birds, whether old or young.

Crushed plump oats should form a large percentage of the growing pullets' grain ration.

THE APIARY.

E. A. EARP, Apiary Instructor.

MANAGEMENT OF APIARY-SITE.

EVERYTHING should now be put in order for the honey-flow, and all facilities given to the bees to enable them to work to their utmost during the harvest. One of the most important things to be attended to is the ground surrounding the hives. Nothing looks more unsightly than overgrown entrances and hives surrounded with long grass and weeds, and for the sake of the

home-coming bees this must receive attention. Do not compel the workers to force their way through a tangled mass of grass and weeds, thereby shortening their already too short lives. A good plan is to skim off the weeds and spread agricultural salt round the hives, using about 6 lb. per hive. Of course, this remedy is not permanent, but should last during the working season. See that the hives are raised from the ground so as to afford a cool draught of air underneath them during the hot weather. As before advised, the hive should be level save for a slight cant towards the entrance. This is important, as upon it depends largely the production of straight combs.

SWARMING.

Leading authorities are mostly agreed that the instinct for natural increase is the cause of swarming. Many beekeepers attribute swarming to overcrowded brood-chambers, lack of ventilation, and poor queens; but it will often happen that swarms will issue when none of these conditions is present. On the other hand, bees will refuse to swarm when everything is apparently conducive to their doing so. It must be left to the beekeeper to decide whether he will increase his stock by natural swarming or artificially. If the former plan is adopted it will be wise to only allow strong colonies to swarm. If a weak hive is showing symptoms of swarming—*i.e.*, if the bees are building numbers of queen-cells—these should be removed and the colony prevented from swarming until such time as it can be requeened. A swarm from a weak hive is not worth encouraging, because it consists simply of a poor queen, probably failing, and a small cluster of bees.

If, however, a strong colony has made up its mind to swarm, the best thing to do is to allow it to throw a prime swarm, and then to most rigorously guard against after-swarming. This can best be done by cutting out all the queen-cells save two after the prime swarm has issued. Even then it is wise to carefully watch the parent hive for about ten days after the departure of the prime swarm, because there will be eggs in the old hive, and the bees may continue to raise queen-cells. In the event of its putting off a second swarm, this should be returned to the parent colony after the virgin queen or queens have been removed from the swarm. A simple method of catching the young queens is to place a queen-excluder between two empty supers. Shake the swarm on the excluder, when the bees will pass through the holes, and the queen or queens can then be picked off the excluder. If these queens are removed the bees will soon return to the parent colony. Young queens obtained in this way are often very useful for forming nuclei or requeening weak colonies.

When a swarm issues, if headed by a laying-queen, it will, after circling in the air for a short time, settle probably on some tree or shrub. As soon as the swarm has settled into a cluster shake all the bees into a box. Place the box on its side and cover with a clean sack, leaving a small opening for the bees to fly in and out. The swarm may be left alone until late in the afternoon. If by that time it has formed a compact cluster in the box the beekeeper will know that all is well and that it contains a queen. Have the hive in readiness, placed in position where it is to remain. Place a clean sack in front of the entrance, having propped up the front to allow the bees a good space to enter the hive. Dump the bees on the bag as close to the entrance as possible, and very soon they will make their way into the hive. The bag can then be removed and the hive lowered into position.

In districts where foul-brood is present, or if the beekeeper is suspicious of his own colonies, it is wise to leave the swarm in the box for at least three or four days. At the end of the period place the bees in the hive as described above, always choosing the late afternoon for settling them in their permanent home. The object of this practice is to induce the bees to utilize the honey in their sacs to draw down comb, and thus rid themselves of honey from the parent hive; if it is followed there will be far less trouble from disease, and swarms will invariably start clean.

Unless there is a good honey-flow, or if bad weather sets in, the swarm should be fed inside the hive. This is to give them a good start and to provide them with material for producing wax. Excellent combs can be produced from sugar-syrup. It is advisable in all cases to hive the swarm on full sheets of foundation, and thus take advantage of the natural instinct of the bees to produce wax after swarming. Very little time will be gained if the bees are put on to drawn-out combs. In the course of a few days it is advisable to examine the frames to note if the queen is laying and to see if the foundation is being drawn out.

When the swarm is placed in the hive do not forget to place a mat on top of the frames. It often happens that unless precaution is taken to confine the bees they will commence operations in the roof of the hive, more particularly if gable roofs are used. Good clean sacking, cut to fit the top of the frames, makes excellent mats.

VENTILATION.

No set rule can be laid down as to how much ventilation bees require. In cases where entrances have been contracted to guard against robbing and the ravages of mice they may now be enlarged. It will be time enough when the main honey-flow is on to provide full ventilation. As a rule it is an easy matter

for the beekeeper to discern whether his bees require more ventilation. The bees, finding their quarters too warm, may be noticed on the alighting-boards driving the cool air through their hives by rapid movements of the wings, and in cases where the temperature is much above normal the bees will hang out in clusters. Should more ventilation be required this may be given by inserting two 1 in. blocks of wood between the front of the bottom board and the hive. This should provide ample ventilation to meet all cases.

ENLARGING THE HIVE.

A little judgment is required as to the proper time to put on the supers. This may be done when the brood-chamber is getting full of bees and during mild weather. As soon as there is a fair flow of nectar the operation should not be delayed, as the bees are liable to be cramped for room. In cases where the beekeeper has plenty of drawn-out combs no trouble will be experienced in getting the bees to go up into the supers. However, where sheets of foundation are used the bees will not readily take to these, and it may be necessary to encourage them. Do not place a queen-excluder between the brood-chamber and the super when the latter is fitted with foundation. Much time is lost and very little honey will be gathered, as the bees will rarely work foundation in the supers when excluders are used. Should the bees not start work in the supers they may be induced to go up by elevating one or two frames of honey from the brood-chambers, at the same time inserting in their place sheets of foundation from the super. On no account break up the brood by transferring it to the super. Until settled weather is experienced this practice cannot be too strongly condemned.

WORKING EQUIPMENT.

It is surprising how few beekeepers provide proper equipment in the shape of convenient tools for manipulating the hives. A little attention paid to the right tools will save endless labour and worry, and will pave the way for fewer stings, besides making the handling of the bees a permanent pleasure. The requisities for handy work are a good smoker, bee-veil, hive-tool, and brush; and if many supers have to be handled a light wheelbarrow is indispensable. One cannot pay too much for a good smoker. It is the most valuable tool the beekeeper possesses, and by its use bees are easily brought under control. Good fuel for the smoker may be made from old bags cut up into pieces. A supply should always be kept in hand. A bee-veil will prevent the beekeeper from getting stung about the face, and enable the hive to be opened up quietly and with confidence. These can be bought

from the dealers in bee supplies. For use in warm weather a very serviceable veil may be made out of cheesecloth. The veil is made in the form of a bottomless bag with a piece of elastic round the top to fit the hat. Cut a hole 6 in. square in front of the face and insert a piece of black veiling. The black inserted piece is indispensable, and without it the operator cannot distinguish the eggs in the cells. Any lady will enlighten one as to the clear vision obtainable through black veiling. A hive-tool for loosening the frames and a brush to clear the bees off the combs form part of a set of good tools, and may be purchased at small cost. In the absence of a brush the left wing of a goose will serve the purpose, being light, pliant, and not likely to injure the bees.

THE FARM GARDEN.

W. H. TAYLOR, Arataki Horticultural Station.

VEGETABLE-CULTURE.

REVERTING to the subject of the growing of leeks, touched upon in last month's notes, I believe no vegetable crop is more profitable in the home garden, and if modern methods were adopted this would be recognized. It is quite wrong to suppose that well-blanched leeks can only be produced in trenches. The writer, when at the Weraroa Experimental Farm, produced leeks weighing 2 lb. each, having about 10 in. of blanched stem. These were grown on the flat in the way now described. Whatever method of growing is adopted, the seed should always be sown in a drill for transplanting. It is quite essential that the plants be transplanted if grown on the flat, and if grown in trenches any other way would be to court failure and give a large amount of avoidable labour. The seed, then, is to be sown fairly thickly in a drill. If the seed is sown now the plants will be ready for putting out by the beginning of January, quite early enough to get the greatest value out of the crop. The plants growing close together in the drill draw up rather, and that is what is wanted. When they are planted they should be about 12 in. high. Choose a plot of good soil for growing them; if this is well manured with stable manure so much the better, but it is not essential, provided the soil be naturally good, as leeks are gross feeders. The soil being well broken up to a good depth, mark the plot out in lines 18 in. apart. Next draw drills as though for sowing peas. The leeks are to be planted in these drills. First sprinkle a little superphosphate and bonemeal along the drills; lift the leeks with a fork,

and separate each. Some people cut the tops off, and some even cut the roots. Do neither—all the roots are wanted, and the leaves help to re-establish the plants. For planting, a good sharp dibber is required. Thrust the dibber in at the bottom of the drill to its full length; give it a circular motion so as to broaden the hole, insert a plant in the hole as far as it will reach, then lift it a little to straighten out the roots, which are apt to become doubled up. Then thrust the dibber into the soil at a little distance from the hole, and when it is well down in the soil bring the handle over to the hole with a firm pressure; this will close the hole and put the plant in position. Nothing more is wanted for the present, and watering will not be necessary, as the roots being well down will find all the moisture they require. Practically nothing else will be wanted but hoeing, to keep the soil open and suppress weeds. The drills will be found to be labour-savers, as the mere filling-in of them at a later stage will destroy all weeds that have sprung up between the plants.

Parsnips and carrots for main crop should be sown in breadth at this time, as they are to stand through winter. Prepare the soil carefully, and sow thinly; it is easier than doing the work roughly and having a lot of thinning to do. Turnips should be sown every seven or eight weeks through the summer months. Sow only a small quantity, just enough to meet current needs; they will not stand long while the weather is hot. Sow red beet for winter use. The long varieties are best for winter; the turnip-rooted sorts are valuable for early use, coming in quickly. Broccoli, Brussels sprouts, Autumn Giant cauliflower, and red cabbage should be sown at once if not already in. Peas are to be sown in the usual way at intervals of about two weeks. French beans may now be generally sown at intervals of four weeks. Runner beans also should be got in at once. The best kinds of runner beans are the comparatively new stringless varieties, of which Epicure is one, which is worth a trial.

In most places all the gourd family, including marrows, pumpkins, melons of different classes, and hardy cucumbers, may now be sown in the open ground. Lettuces should not be transplanted at present; it is better to sow in lines and thin out; the plants come quicker, and are far less trouble.

Tomato-plants are best grown in shelter until reasonably safe from frost, as they do not make any growth to speak of until warm weather is fairly continuous. The first half of November I consider the best time to plant in the middle districts of the Dominion. Of course, there are some places not far apart where the conditions are quite different; one can only speak generally. Growers are again warned against using so much water as is

common in tomato-culture. I never water, and get good crops with little or no disease.

SMALL FRUITS.

Cape gooseberries may be planted when safe from frost. Last year's plants that are to be kept to fruit again should be cut down to near ground-level.

The soil should be kept open around young strawberry-plants: this will do more to make them grow than will anything else.

Newly planted loganberries should be allowed to retain all the growth they make—the more the better.

Check suckers in raspberry plantations by frequent cultivation. The beds should be kept free of weeds; if couch gets possession it may ruin the plantation.

THE FLOWER-GARDEN.

Chrysanthemums should be planted out by now; if not, it is as well to get this done, as the plants may not take easily when the sun gains more power. The plants should be renewed each year, as the growth they make is more likely to be satisfactory than if left alone, although the let-alone method has its merits in some cases. For instance, old clumps left in a border are likely to give large cuttings of flowers, which, though they will not be of a high order taken as separate flowers, yet in the mass may be found more pleasing than a smaller number of fine flowers on a stronger plant. Moreover, the old plants give but little work, for they need not even be tied up. I have known such plants to be appreciated. In a similar manner dahlias may be left alone. The flowers are never of the best, but there is a mass of them, and they come early. The left-alone clumps are quite suitable for leaving in borders among shrubs, where they make a good show without attention.

Most spring bulbs are looking worn by now; they should not, however, be lost sight of on that account; keep the soil loose about them, so that they may finish well. Narcissi that it may be desired to lift should be taken up before the foliage is quite dead. When it is yellow is the time, for many of the bulbs have new roots by the time the foliage is dead. After lifting, leave the bulbs lying in the sun till the foliage dries off.

Half-hardy annuals of the aster, &c., type may be sown in the open ground.

Early-flowering shrubs should be pruned as soon as flowering is past. This is necessary in order to give the resultant growth time to mature before winter, and on this operation depends the quality of next year's flowers.

ANSWERS TO CORRESPONDENTS.

IN every instance a question to which an answer is desired in these columns must be accompanied by the full name and the postal address of the inquirer, not necessarily for publication, but as a guarantee of good faith. The question should be written on one side of the paper only.

DISTEMPER IN DOGS.

T. D. R., Glen Falloch, via Whakamatau :—

We have had an outbreak amongst our collies and have lost many valuable animals. They run at nose and eyes—not palsy distemper. Would you kindly furnish me with the best cure ?

The Live-stock Division :—

The best treatment to adopt would be to carefully disinfect all kennels, and give the affected animals milk, milk-slops, beef-tea, and a teaspoonful of Parrish's syrup of phosphates twice daily. The dogs should, of course, be kept warm and dry.

NEGLECTED PRUNING.

H. C. M., Waimate :—

Should an apple or pear tree unpruned for two years be taken off below the last year's growth, or that of the year before ?

The Horticulture Division :—

It is difficult to answer your question without seeing the tree. If the tree is comparatively young the branches would be weak through the lack of pruning, in which case it would be advisable to cut back hard to secure stability and shape, and to otherwise invigorate the tree. This would probably mean cutting back into the wood formed the first season that pruning was neglected. If the tree is a mature one, the cutting-back must be governed by the vigour of the tree and the strength of the leaders—cutting sufficiently hard to provide for strength to encourage growth.

LIME FOR BORDEAUX MIXTURE.—BREAKING DOWN BONES.—VERMORITE.

"NOVICE," Levels, Canterbury :—

1. Would you kindly tell me the difference between the two kinds of lime—that which slakes down out of lumps without generating heat, and the other that gets very hot under similar conditions. Are they both suitable for making Bordeaux mixture ?

2. Is there any means other than crushing by which I could turn the various bones that are usually found about a farm into a manure ? Such bones are sheep's trotters, skulls, &c. I had thought of piling them together and covering them with hot lime. Would that break them down ?

3. I noticed in the July *Journal* that vermorite was used at Moumahaki for spraying potatoes last season. What is vermorite ? Is it any easier to prepare and use than Bordeaux ?

The Fields Division :—

1. It is assumed that the two forms of lime that you are referring to are—(*a.*) Burnt lime that has been exposed to the atmosphere for some time, thus taking up carbon dioxide from the air and reverting to the carbonate form. A portion of the lime has not "air-slaked," and this upon the application of water would

slake, forming hydrate of lime, generating some heat in the process. (*b.*) Freshly burnt lime, or comparatively so, in the form of "shells" (burnt rock fragments) that generates considerable heat upon slaking with water, on account of it being practically all in the oxide or burnt form. The latter, freshly burnt lime, is much more suitable for making Bordeaux mixture, as hydrate (not carbonate) is used in making a lime-water solution.

2. Bones may be broken down on the farm for manure purposes by placing them in roofed watertight bins and enveloping them well with earth well saturated with liquid manure. Quicklime would have the tendency to drive off the nitrogenous portion in the form of ammonia, whereas the liquid manure and earth would not only conserve the nitrogen, but also add a valuable manurial constituent in the form of potash, with which the liquid is well supplied.

3. Vermorite is a commercial spraying fungicide used for spraying for leaf-curl, potato-blight, &c. It is prepared ready for use, but would be more costly and not more effective than Bordeaux mixture.

WEED-KILLER FOR GARDEN PATHS.

J. S. EDELSTEN, Feilding :—

Could you advise me the best preparation to use on metalled paths to keep them free from weeds ?

The Horticulture Division :—

The following has proved very effective in killing weeds on garden paths, &c. : Dissolve 1 lb. of powdered arsenic in 3 gallons of cold water ; boil and keep stirring ; then add 7 gallons of cold water and 2 lb. of crushed washing-soda ; stir the whole well while boiling, and with a rose watering-pot apply to the paths in dry weather. This will be sufficient for spraying 25 square yards. An inclined board should be placed at the sides of the walks to keep the liquid off the grass or other live edging, otherwise it will be killed.

ERADICATING GORSE.

F. W. S., Waipu North :—

I have bought a farm at North River, Waipu, and it has a considerable quantity of gorse on it. Some of the land under gorse is river-flat, but most of it is low or gently sloping hills. There is limestone on the property. What would you advise as the best, quickest, and cheapest methods of getting rid of the gorse ?

The Fields Division :—

The best method of eradicating gorse is by grubbing. Where the gorse is not too strong and the land can be ploughed the use of the plough is the most effective, quickest, and cheapest method. Any young growth that may come up can be again ploughed under. If the second ploughing is not convenient, sheep could be confined to comparatively small areas to keep down the young gorse. Where firing is permissible the vigorous growth of gorse could be burnt, and a large wooden roller could be employed to flatten out any unburnt growth. This could be subsequently ploughed under by a swamp-plough. This method, of course, is feasible only in the event of your land being ploughable.

LINSEED.

F. A. BOAKES, Brookby :—

Could you inform me if linseed grows to advantage in New Zealand, and whether it would thrive on a clay soil ; also would it do for fattening pigs ?

The Fields Division :—

Linseed grows well in New Zealand on land suitable for it. A clay soil would not be suitable. It requires a very rich soil, being somewhat of an exhausting crop. The seed would be too rich and expensive to be used for fattening pigs. The seed fetches a good price on the market.

NEW-ZEALAND-FLAX CULTURE.

D. M. LUSK, Christchurch :—

How is flax (Phormium) seed planted—to what depth and to what distance apart? How long after planting will the flax be ready for cutting, and how many years before one can cut again?

The Fields Division :—

Phormium-seed should be sown similarly to onion-seed, but much thinner. When the plants are sufficiently strong they should be transplanted in rows, 4 ft. apart. Flax grown from seed takes from six to eight years to mature, according to climatic and soil conditions. After being cut or harvested, it is between three and four years before the next growth of leaves can be gathered.

SOFT-BOTTOMED DRAINS.

"SUBSCRIBER," Hamilton :—

What is the best material to use for drains where the bottom is too soft for tiles?

The Fields Division :—

If the subsoil is not too loose, but loose enough for the water to undermine the drainpipes, you could place the latter on 6 in. by 1 in. boards laid carefully along the bottom of the loose-bottomed ditch. This supports the pipes. If thought necessary, the boards could be tarred to make them last. If, however, the ground is very loose, you had better construct fluming or boxing for the bad stretch of drain, the fluming being made of a size of boards that will suit the size of pipes employed. The joints between the fluming-ends and the pipes should be neatly jointed, plastic clay being used, if necessary, to seal the junctures. The fluming could be tarred to protect the wood if considered advisable.

SWELLING IN SHEATH OF WETHERS.

JOHN E. JENNINGS, Motu, Gisborne :—

Could you advise me how best to treat what appears to be a stoppage or considerable swelling of the urethra in four-tooth or older wethers, resulting in blood-poisoning and death in odd cases. The sheep are in forward condition, belly-wool much stained. The time would be before shearing, in October or later. The sheep are running on the Poverty Bay flats.

The Live-stock Division :—

The swelling in the sheath is generally due to a decomposition of salts, &c., from the urine, and in some cases by foreign substances gaining access. Treatment consists in washing out the sheath and removing the deposit by means of an enema syringe and warm soapy water, then applying a little boracic ointment.

OATS FOR FEEDING AND CROP.

"INQUIRER," Nelson :—

I want to sow a paddock with Dun oats (good land, partly drained swamp) with the intention of fattening a few lambs during late summer and autumn. If sown in the middle of December, could I then expect a crop the following year after being fed off? If not, when is the earliest that it is safe to sow?

The Fields Division :—

If the oats are sown in the middle of December they would mature this season and would not carry over until the following year. If, however, you sow, say, about the middle of February, you could feed them off two or three times, and then let them go to provide a crop for next year. We would advise your feeding the oats off each time well before there is any danger of them heading out, yet at the same time letting them go to provide good growth for feeding off. Also allow sufficient growth to take place before the frosts of winter set in, so as to carry them through. This can be regulated by judicious feeding-off.

CONTROL OF TUTU AND BUSH-LAWYER, ETC.

"OVERRUN," Roxburgh :—

You would be rendering me considerable assistance by giving information on the following :—

1. Tutu : Any method of dealing with it on a large scale on a run, or minimizing its bad effects.

2. Bush-lawyer : Also any method of dealing with it on a very large scale on a run. Sheep continually get hung up in it.

3. A handy torch for burning on a large scale.

The Fields Division :—

1. Tutu is very difficult to eradicate. After cutting, the underground stems rapidly shoot up again. If there is only a small quantity to deal with, grubbing the plants may be undertaken, but where present on a large scale, cutting and burning is the only method to adopt. On heavily stocked ground tutu may be crushed out, but of course strange stock will suffer. After burning, grass-seed should be sown, because when there is an abundance of young grass tutu is generally not eaten.

2. Cutting and burning is the only method to adopt with bush-lawyer. Spraying with some poisonous mixture might be tried, but would probably be too expensive and then not effective, so it could not be advised.

3. There are some torches for burning on the market, but none are a success, mostly on account of expense. The best way is to have a rough torch of rags or bagging soaked in kerosene or fat.

ABERDEEN-ANGUS BEEF.

"TASSY," Smithton, Tasmania :—

Does the Aberdeen-Angus and its crosses make a suitable and profitable carcase for export purposes ? Is there any objection to the yellow-coloured fat ?

The Live-stock Division :—

There is nothing better for export purposes than an Aberdeen-Angus cross, either with Shorthorn or Hereford. The yellow-coloured fat referred to must be due to some other cause, as it is certainly in no way due to this particular breed of cattle.

LUCERNE-GROWING FOR HARD-PAN CONDITIONS.

S. HAROLD WILSON, Waituna, Waimate :—

Would you advise me as to the method of growing lucerne on a cold soil with a hard subsoil ?

The Fields Division :—

A cold soil with a hard subsoil is not suited for successfully growing lucerne. However, if you care to try the crop you could prepare a small area on the following lines : Assuming that the surface soil has previously been in potatoes, roots, or some other cleaning-crop, plough with a single-furrow plough about 6 in. deep in the opposite direction to the last ploughing, and in every furrow use another single-furrow plough with the mouldboard removed and with the wing of the share knocked off. This tears up the more or less stiff subsoil. Having thus ploughed and subsoiled your ground, apply 1 to 1½ tons of ground burnt lime per acre, and work this in with the disk and tine harrows. The growing of a crop of peas and ploughing this under will be of decided benefit on your type of land. The lucerne could be sown in about a month after turning under the peas. When working up the land for the crop of lucerne apply about 3 cwt. per acre of soil that has already grown the crop successfully. Apply and work this in with the harrows in the evening when the light is obscure or during an overcast day. As manure for the peas use 1 cwt. basic superphosphate and 1 cwt. blood-and-bone manure, applied the same day as mixed. When sowing the lucerne apply 2 cwt. basic superphosphate—assuming that you have previously manured the peas. The Partridge or the Prussian Blue pea would be suitable. We would advise your trying for a start not more than 1 acre of lucerne, for which you will require 15 lb. to 20 lb. per acre of Marlborough-grown (colonial) seed. We are afraid, however, that the iron-stone pan which exists at Waituna will interfere with the successful growth of the crop.

AGRICULTURAL INSTRUCTION AND TRAINING.

RECOMMENDATIONS OF COUNCIL OF EDUCATION.

THE recommendations in regard to agricultural and industrial education, framed by the Council of Education at its general meeting held at Wellington in September, are recorded below for convenient reference. It will be observed that the recommendations provide for a complete sequence in agricultural and industrial training from the very elementary stages represented by nature-study and manual and domestic instruction provided for in the primary schools to the most advanced stages of agricultural and technical education required for the training of experts and instructors in these subjects. Another feature of the recommendations is the ample provision therein made for the training of school-teachers and other instructors on whose efficiency the success of the scheme naturally depends.

The recommendations are as follows :—

1. That nature-study and the school-garden should be included in the course of instruction of every primary school, the school-garden being used as the laboratory for simple experiments on and for observation of the common facts of plant-life.

2. That in every locality, whether at a district high school, technical high school, or high school, there should be provided an intermediate agriculture course of two or three years, both theoretical and practical. (This need not injure the general education of the pupils who take it.)

2A. That all district high schools with an average attendance not exceeding seventy should follow exclusively an agricultural or other industrial course.

3. That for those who have left the primary school at fourteen years of age to go to work there should be courses, if possible during the day, for part of the year but continuing for three or four years, of similar range and standard—that is, secondary or intermediate in character.

NOTE.—Such classes might be held, say, one day a week or two half-days twice a week for thirty weeks in the year, if possible ; or if not then, say for two days a week for twenty weeks, or five or six days a week for three or four weeks—in each case the busiest part of the year being avoided.

3A. That for those who have spent at least two years in one of the courses 2 or 3 above, and who are prepared to give their whole time for two years longer to instruction in agriculture, there should be established in each Island a farm school.

4. That every male student of a training-college should go through a course in agriculture not lower in standard than the intermediate course just referred to.

Special teachers of agriculture would be required for these courses 2, 3, 4.

4A. That for male teachers agriculture of the D standard should be a compulsory subject in the C and D certificate examinations.

5. That the Agriculture Department and the Education Department should co-operate to make one of the State experimental farms (say, Ruakura) a place for the further training of those who have completed one of the intermediate courses 2, 3, or 4—whether such persons are intending to be teachers or farmers.

6. That to qualify themselves to be efficient teachers of rural schools, ex-students of training-colleges should be encouraged to take one year at such experimental farm. Special inducements should be held out to students to take this course by assuring to them an appointment to a rural school of Grade II or upwards, and a minimum salary of, say, £170 per annum.

7. That to qualify themselves to be special teachers of agriculture (*e.g.*, for the intermediate course 2 or 3) those who have taken one or two years at a training-college should take a course of two years at the experimental farm; and that the minimum salary for a certificated teacher thus qualified to be a special teacher should be £250 per annum. (The allowance payable to students taking the course 6 or 7 should be not less than £35 per annum, exclusive of the cost of board and tuition.)

Students under classes 6 and 7 should enter into bond to teach for not less than five years in New Zealand.

8. Other students should receive an allowance of £20 per annum, in addition to board and lodging, and, besides, in the case of those selected to work for half time or less, wages at a reasonable rate.

9. That Senior National Scholarships should be tenable at Ruakura.

10. That to train scientific experts in agriculture there should, by co-operation between the Departments named, be admitted to one of the experimental farms set apart for higher research in agriculture (say, Weraroa) youths who are holders of a leaving certificate (by preference a higher leaving certificate, a foreign language being not, however, compulsory).

That bursaries similar in value and conditions of tenure to the home science bursaries now tenable by women at the University of Otago be offered to qualified young men who wish to take a three-years course at Weraroa.

11. That National Research Scholarships should be tenable at Weraroa.

12 (*a.*) That the principle of compulsory attendance at continuation courses of youths between fourteen and seventeen years of age should be adopted throughout the Dominion.

(*b.*) That it should not be lawful to employ any person between the ages of fourteen and seventeen unless such person could produce a certificate of satisfactory attendance and progress at such classes.

(*c.*) That time off should be allowed by employers to the extent of at least one half-day a week to enable persons in their employ between the ages of fourteen and seventeen to attend continuation classes.

(*d.*) That wherever possible the continuation classes should be held in the daytime.

13. That students who have made satisfactory attendance and progress in any trade class at an approved technical school should receive recognition of the fact when applying for admission to the corresponding trade department of the Public Service.

14. That the chairman communicate to the Lincoln Agricultural College authorities the recommendations made concerning agricultural education, and ask them to consider how far they would be prepared to render assistance on the lines indicated in this report.

A large stack of red-clover hay at Ruakura was recently chaffed, and it is intended to feed this to the horses mixed in with oat-sheaf chaff. By this method there is no loss from dropping of the leaf, which is unavoidable when clover is fed as hay in racks.

At Ruakura during the hardest part of the winter large quantities of meadow and lucerne hay, pea-straw, oat and barley straw, and mangels were carted out daily to the stock in the paddocks, the farm being very heavily stocked. The heaviest feeding was carried out on the poorest swamp land (fields 22A and 42). It is hoped that very beneficial results will follow this system of bringing in poor swamp land of the Ruakura type. Apart from the treading-out of sorrel, the land is consolidated and receives a large amount of animal manure by the process of stocking and feeding

GERMAN AND BRITISH AGRICULTURE COMPARED.

THE English Board of Agriculture has published a valuable and interesting memorandum by its Assistant Secretary, Mr. T. H. Middleton, C.B., entitled "The Recent Development of German Agriculture." Under the heading of "Some Lessons" Mr. Middleton summarizes his study as follows:—

1. The German farmer now produces about the same weight of cereals and potatoes per acre as the British farmer, but a much greater weight per 100 acres of cultivated land. The German produces about the same weight of meat and nearly twice as much milk per 100 acres as the British farmer. The German feeds from seventy to seventy-five persons per 100 acres of cultivated land; the British farmer feeds from forty-five to fifty.

2. The ascendency of the German has been gained in the past forty years.

3. The soil and climate of Germany are less favourable to agriculture than those of Britain.

4. The actual methods of tillage adopted in the growing of corn, potatoes, &c., in Britain are not inferior to the methods adopted in Germany. The difference in production is chiefly due to the circumstance that in Britain more than two-thirds of the cultivated land is now in grass, while in Germany less than one-third of the cultivated land is in grass. There has been a slight decrease in the area annually ploughed in Germany; in England and Wales the area which is annually ploughed decreased by about 26 per cent. in the forty years before the war.

5. German land is mostly tilled by peasant owners, British land by tenants. The German depends to a great extent on women labour, provided by the families of the occupiers. Wages are relatively low in Germany, and rural industries help to provide winter employment and tend to cheapen summer labour.

6. Much attention has been given to organizing production from German soil. The credit system is well adapted to promote good farming. Co-operation is largely resorted to. Education has been well developed. Societies have been created to provide leadership

7. German economic policy in recent years has favoured agriculturists, who have benefited partly from the higher prices resulting from tariffs and partly from the steadying effect which the known policy of the State has had upon the industry.

8. The general effect of the agencies and influences mentioned in the two preceding paragraphs has been to produce a very rapid improvement in the technical methods of the German farmer. The use of manures and feeding-stuffs has greatly increased. Superior strains of both plants and animals have been raised. Business methods have been introduced, and important rural industries have been developed.

In his concluding remarks Mr. Middleton says,—

"If one attempts to summarize in a paragraph the impressions produced by a study of the recent progress of German agriculture, the conclusion is that from the agricultural policy of Germany we may learn something, and from the admirable machinery—administrative, educational, and commercial—set up to lead, teach, and finance agriculturists we may learn much. On the other hand, from the actual processes of German husbandry there is relatively little to learn. In many parts of Britain the tillage of the soil and the management of stock are as good as anywhere in Germany. When we set about increasing the food-supply of the country we may find examples of the necessary methods without looking across the Rhine; and, fortunately, there is not any reason to suggest that before our farmers can hope to regain the position which British agriculture has lost they must be prepared to remodel their own practice from seed-time till harvest on the farming of the Fatherland, and to write the name of their ancient industry with a 'k'!"

COMMERCIAL INTELLIGENCE.

LONDON WOOL-SALES.

FOLLOWING is the High Commissioner's cabled report, dated 22nd September, 1916, regarding the closing of the sixth series of London wool-sales:—

The wool-sales closed with a good demand for all classes of wool. Prospects are favourable. Estimated closing-values are as follows: Fine crossbreds, 1s. 9d. to 2s.; medium crossbreds, 1s. 5d. to 1s. 7d.; coarse crossbreds, 1s. 3d. to 1s. 6½d.; superior merino, 1s. 10d. to 2s. 1d.; medium merino, 1s. 6d. to 1s. 9d.; inferior merino, 1s. 2½d. to 1s. 5d.

5,500 bales of New Zealand wool are held over.

FRANCE AND FROZEN MEAT.

THE French Chamber of Deputies on the 6th June last passed a private Bill authorizing the purchase by the Minister of War, for the use of the army, of a maximum amount of 30,000 tons of frozen meat per annum, to be supplied exclusively from Algeria and the French colonies and protectorates—one-fifth of the quantity to consist of mutton.

SHEEP STATISTICS.

THE sheep statistics printed in last month's *Journal* gave the number of sheep in New Zealand in 1915 as 24,824,394, as published last year. This number did not include certain late supplementary returns (8,661), nor the sheep in the Chatham Islands (68,366). Adding these two items, the total for 1915 is 24,901,421. The total for 1916—viz., 24,788,150—includes the Chatham Islands. Comparing the totals for the two years on this basis, the decrease in 1916 is shown to be 113,271. It may be mentioned that the Chatham Islands flocks have not been included in the annual sheep returns until the present year. They are now embodied in the Canterbury-Kaikoura Sheep District.

ORCHARD-TAX ACT REGULATIONS.

THE following regulations under the Orchard-tax Act, 1916, have been issued:—

1. For the purposes of these regulations—
   "Federation" means the New Zealand Fruitgrowers' Federation (Limited):
   "Director" or "Assistant Director" means the Director or Assistant Director of the Horticulture Division of the Department of Agriculture, Industries, and Commerce.

2. The moneys paid to the Federation pursuant to the said Act may be utilized for all or any of the following purposes:—
   (*a.*) The establishment and maintenance of the registered office of the Federation:
   (*b.*) The payment of salaries and travelling-expenses of officers in the employ of the Federation:
   (*c.*) The purchase of orchard requisites required by the Federation for testing purposes:
   (*d.*) The investigation, testing, and opening-up of new markets for the export of fruit:
   (*e.*) The organization and improvement of local fruit-markets:
   (*f.*) The defraying of expenses in connection with executive meetings of the Federation and the annual conference of fruitgrowers:

Provided that the general policy of the Federation in relation to the matters referred to in paragraphs (*d*) and (*e*) of this clause must receive the written approval

of the Minister of Agriculture before any expenditure of moneys paid to the Federation under the said Act is incurred in respect thereto.

3. All books necessary for keeping an account of moneys received and expended by the Federation under the said Act and these regulations shall be kept at the registered office of the Federation, and shall be open at all times for inspection by a duly authorized Government officer. All such books shall be carefully and correctly kept in a form to be approved by the Director, and an audited balance-sheet for the preceding year shall be furnished to the Director not later than the 30th day of April in each year.

4. (*a.*) In the event of a dispute arising as to the boundaries or area of any orchard for the purpose of the said Act, the Director, or other duly authorized officer acting on his behalf, shall determine such boundaries or area, and his determination shall be final.

(*b.*) For the purpose of determining the area of any orchard the Director, or such other duly authorized officer, may order a survey to be made at the expense of the occupier.

5. All moneys due under the said Act shall be payable at any money-order post-office in the Dominion.

6. The Director, or in his absence the Assistant Director, shall have the right to be present at any meeting of the Board of Directors of the Federation; and it shall be the duty of the Secretary of the Federation, or other officer acting in that capacity, to give to the Director or Assistant Director reasonable notice of every such meeting.

REGISTRATION OF ORCHARDS.

THE following regulations under the Orchard and Garden Diseases Act, dealing with the registration of orchards, have been issued, and came into force at date of gazetting—5th October, 1916:

1. For the purposes of these regulations—

"Director" means the Director of the Horticulture Division of the Department of Agriculture, Industries, and Commerce:

"Fruit-tree" means any variety of apple, pear, quince, peach, nectarine, plum, cherry, apricot, nut, or citrus tree, or grape-vine:

"Occupier" means the occupier within the meaning of the Rating Act, 1908.

2. Every occupier of an orchard shall, within twenty-one days after the publication of these regulations in the *Gazette*, and thereafter in the month of September in each year, make application to the Director, in or to the effect of the form No. 1 in the Schedule hereto, for the registration of such orchard, and shall certify whether or not any fruit has been sold from such orchard while occupied by him during the twelve months ended the 31st August preceding.

3. As soon as practicable after the receipt of any such application the Director shall issue to the applicant, free of charge, a certificate of registration in respect of such orchard, in the form No. 2 in the Schedule hereto.

4. Forms of application for registration of an orchard shall be obtainable from the Director, or from any District Agent or Orchard Instructor of the Department of Agriculture, Industries, and Commerce.

5. Nothing in these regulations shall apply to such orchards as are nurseries within the meaning of the said Act, or to any orchard unless the same is used for the growing of fruit-trees as defined by clause 1 of these regulations.

Form No. 1, referred to in Regulation 2, is drafted as follows:—

APPLICATION FOR REGISTRATION OF AN ORCHARD.

Name of applicant: . Address of applicant: .
Situation of orchard: At or near (Section No. , Block No. , in the Survey District).
Area of orchard: acres [*or* Number of trees grown:].

To the Director of the Horticulture Division, Department of Agriculture, Industries, and Commerce, Wellington.

I HEREBY apply, in pursuance of the regulations under the Orchard and Garden Diseases Act, for the registration of the above-described orchard, of which I am the occupier. I hereby certify that during the time such orchard was occupied by me in the twelve months ending 31st August last [no] fruit was sold therefrom.

[*Signature and Date.*]

IMPORTATIONS OF FRESH FRUIT.

THE following table shows the varieties and quantities of fresh fruits imported into New Zealand at the different ports of inspection during the year ended 31st March, 1916. The figures represent cases.

Port of Inspection.	Apples.	Pears.	Loquats.	Grapes.	Plums.	Cherries.
Auckland ..	29,627	879	313	..	..	2,475
Wellington ..	11,298	252	342	211	..	3,210
Christchurch ..	4,672	30	121	86	..	30
Dunedin ..	10,209	..	43	146	..	..
Bluff	929	20	..	..	..	120
Totals ..	56,735	1,181	819	443	..	5,835

Port of Inspection.	Oranges.	Mandarins.	Lemons.	Pines.	Passions.	Bananas.
Auckland ..	79,842	8,178	2,337	4,403	1,266	169,456
Wellington ..	40,857	16,822	9,161	4,702	2,896	43,187
Christchurch ..	23,128	3,912	3,039	1,498	1,124	29,424
Dunedin ..	16,323	2,084	1,855	1,508	891	20,698
Bluff	2,314	608	570	352	220	1,951
Totals ..	162,464	31,604	16,962	12,463	6,397	264,716

The totals of all varieties imported at the several ports are as follows: Auckland, 298,776; Wellington, 132,938; Christchurch, 67,064; Dunedin, 53,757; and Bluff, 7,084 cases. The grand total for the Dominion is 559,619 cases, as against 604,538 cases in the previous twelve months.

STOCK EXPORTED.

THE following table shows the numbers and descriptions of stock exported from the Dominion during the month of September, 1916:—

Port of Shipment.	Horses.		Sheep.			Cattle.		Pigs.
	To Australia.	To Eastern Pacific.	To Australia.	To Eastern Pacific.	To San Francisco.	To Australia.	To Eastern Pacific.	To Eastern Pacific.
Auckland ..	2	..	..	178	..	..	17	36
Gisborne ..	..	..	..	..	..	..	..	..
Napier ..	..	..	..	..	..	..	..	..
Wellington ..	..	..	..	..	..	..	..	..
Lyttelton ..	4	..	..	..	..	..	..	..
Dunedin ..	..	..	..	..	..	..	..	..
Bluff ..	..	..	..	..	..	..	..	..
Totals ..	6	..	..	178	..	..	17	36

The following are particulars of horses shipped: Thoroughbred, 3 geldings; trotting, 2 geldings, 1 mare.

LONDON MARKET VALUES.

COMPARATIVE STATEMENT COMPILED FROM THE HIGH COMMISSIONER'S CABLES FOR THE PAST THREE MONTHS.

London Date.	Wool. Bradford Quotations for Tops. 36's.	40's.	44's.	50's.	56's.	60's.	Mutton. Canterbury.	Mutton. North Island.	Lamb. Canterbury.	Lamb. Other than Canterbury.	Beef. New Zealand Hinds.	Beef. New Zealand Fores.	Butter. Danish.	Butter. New Zealand.	Cheese. New Zealand White.	Cheese. New Zealand Coloured.	Cheese. Canadian.	Hemp (Spot). New Zealand Good-fair.	Hemp (Spot). New Zealand Fair.	Hemp (Spot). Manila Fair (New Grade).	Hemp (Forward Shipment). New Zealand Good-fair.	Hemp (Forward Shipment). New Zealand Fair.	Hemp (Forward Shipment). Manila Fair (New Grade).	Wheat. N.Z. Short-berried.	Wheat. N.Z. Long-berried.	Oats. N.Z. Sparrowbills.	Oats. N.Z. Danish.
							d.	d.	d.	d.	d.	d.															
1916. July 8	..	..	..	..	..	..	*8⅝	..	*9½	..	6	5½	173/0	169/0	96/0	95/0	93/0	48/10/0	47/0/0	52/0/0	48/0/0	46/0/0	50/10/0	..	..	..	..
,, 15	..	..	..	..	..	..	*8⅝	..	*9½	..	6	5½	172/0	167/0	85/0	85/0	86/0	48/10/0	47/0/0	52/0/0	48/0/0	46/0/0	50/10/0	..	..	..	..
,, 22	..	..	..	..	..	..	*8⅝	..	*9½	..	..	..	173/0	167/0	89/0	89/0	89/0	48/10/0	47/0/0	51/0/0	47/10/0	45/10/0	49/0/0	..	..	..	..
,, 29	..	..	..	..	..	..	*8⅝	..	*9½	..	5⅝	5½	176/0	169/0	91/0	88/0	90/0	48/10/0	47/0/0	51/10/0	47/10/0	45/10/0	49/0/0	..	..	..	..
Aug. 5	..	..	..	..	..	..	*8⅝	..	*9½	..	5½	4[illegible]	184/0	174/0	92/6	93/0	93/0	49/0/0	47/0/0	51/10/0	48/10/0	46/10/0	51/0/0	..	..	..	..
,, 12	..	..	..	..	..	..	*8⅝	..	*9½	..	5¾	4¾	195/0	176/0	96/6	94/6	95/0	49/0/0	46/10/0	51/10/0	48/10/0	46/0/0	..	..	..	..	..
,, 21	..	..	..	..	..	..	*8⅝	..	*9½	..	5	4½	198/0	178/0	97/10	96/0	96/10	48/10/0	46/10/0	51/10/0	47/10/0	45/10/0	51/0/0	..	..	..	..
,, 28	..	..	..	..	..	..	*8⅝	..	*9½	..	..	..	203/0	184/10	101/0	101/0	102/0	48/10/0	46/10/0	51/10/0	48/0/0	46/0/0	51/0/0	..	..	..	..
Sept. 4	..	..	..	..	..	..	*8⅝	..	*9½	..	..	..	197/0	186/10	103/0	103/0	103/10	49/10/0	47/10/0	52/0/0	49/0/0	47/0/0	51/0/0	..	..	..	..
,, 11	..	..	..	..	..	..	*8⅝	..	*9½	..	..	..	196/0	186/10	104/0	104/0	..	49/10/0	47/10/0	51/10/0	48/10/0	48/10/0	50/10/0	..	..	..	..
,, 16	..	..	..	..	..	..	*8⅝	..	*9½	..	5½	4½	197/0	187/0	105/0	105/0	105/0	49/10/0	47/10/0	52/0/0	49/0/0	47/0/0	51/0/0	..	..	..	..
,, 23	..	..	..	..	..	..	*8⅝	..	*9½	..	..	..	202/0	191/0	105/0	105/0	106/0	50/0/0	48/0/0	52/0/0	49/10/0	47/10/0	51/10/0	..	..	..	..
,, 30	..	..	..	..	..	..	*8⅝	..	*9½	..	..	..	207/0	200/0	107/0	107/0	108/0	50/0/0	48/0/0	52/0/0	49/10/0	47/0/0	..	..	..	..	..
Oct. 7	..	..	..	..	..	..	*8⅝	..	*9½	..	6½	5½	211/0	198/6	109/0	109/0	111/0	50/0/0	48/0/0	52/0/0	49/10/0	47/0/0	51/10/0	..	..	*33/	..

* Specified as "New Zealand."

NOTE.—All the above beef quotations are specified as "N.Z. bull-beef." In cable of 5th August "N.Z. cow-beef" was quoted—hinds, 5 3/16d.; fores, 4¾d.

NEW ZEALAND EXPORTS TO BRITAIN.

COMPILED FROM MANIFESTS OF VESSELS SAILED DURING RESPECTIVE MONTHS OF CURRENT AND PRECEDING SEASONS.

Month.		Mutton, Carcases.	Lamb, Carcases.	Beef, Quarters.	Pork, Carcases.	Butter, Boxes.	Cheese, Crates.	Wool, Bales.	Wheat, Sacks.	Oats, Sacks.	Rabbits, Crates.	Hemp, Bales.	Tow, Bales.	Kauri-gum, Pkgs.
January,	1916	166,700	295,170	41,726	179	108,593	101,917	92,849	..	..	..	7,438	1,666	1,218
,,	*1915*	*137,816*	*296,439*	*45,622*	*339*	*138,081*	*85,123*	*87,393*	..	..	*2,860*	*683*	..	*1,209*
February,	1916	170,973	266,414	29,056	23	96,096	84,740	96,016	..	..	..	8,161	1,804	1,900
,,	*1915*	*433,585*	*517,581*	*77,421*	*311*	*119,371*	*96,090*	*159,347*	..	..	..	*13,111*	*6,619*	*2,763*
March,	1916	327,977	363,269	83,725	..	59,671	62,082	49,750	..	..	474	2,666	637	1,247
,,	*1915*	*80,439*	*203,480*	*30,176*	..	*55,280*	*51,811*	*49,809*	..	..	..	*8,410*	*185*	*274*
April,	1916	108,488	195,707	106,369	..	24,703	81,652	41,725	..	..	..	3,782	337	450
,,	*1915*	*286,155*	*328,779*	*45,340*	..	*6,703*	*38,561*	*41,371*	..	..	*1,011*	*9,328*	*1,474*	*3,461*
May,	1916	170,164	282,156	134,971	..	26,789	56,961	26,356	..	..	1,000	2,892	235	731
,,	*1915*	*257,953*	*433,831*	*34,780*	*655*	*148*	*17,065*	*21,615*	..	..	*2,923*	*4,968*	*808*	*2,636*
June,	1916	138,303	290,319	41,593	..	10,289	18,463	22,998	..	..	5,439	5,260	2,076	1,219
,,	*1915*	*99,080*	*154,785*	*19,316*	*932*	..	*26,869*	*11,946*	..	..	*9,800*	*5,027*	*1,320*	*1,229*
July,	1916	367,827	593,670	42,322	..	4,209	30,940	50,804	..	..	10,950	9,244	3,720	3,230
,,	*1915*	*243,420*	*340,476*	*21,231*	*154*	..	*21,520*	*16,039*	..	..	*5,968*	*5,068*	*1,639*	*4,184*
August,	1916	238,926	266,390	76,755	..	9,810	32,178	18,713	3	..	9,725	7,463	1,868	3,293
,,	*1915*	*510,418*	*570,381*	*51,750*	*35*	..	*18,287*	*19,416*	..	..	*31,790*	*7,138*	*1,466*	*4,848*
September,	1916	272,848	163,852	75,422	..	185	..	6,786	7,421	..	23,445	4,494	2,428	1,123
,,	*1915*	*299,715*	*330,643*	*59,487*	..	*26,416*	*2,595*	*5,360*	..	..	*7,750*	*2,022*	*3,091*	*595*
October,	1915	367,198	417,794	87,104	..	111,468	49,160	7,272	..	..	56,636	5,650	1,645	1,230
,,	*1914*	*291,432*	*128,016*	*49,104*	..	*81,842*	*30,487*	*8,938*	..	*68,660*	*38,121*	*2,042*	*1,650*	*1,683*
November,	1915	93,777	92,601	21,609	..	81,102	47,243	18,715	..	..	13,538	5,064	1,789	868
,,	*1914*	*136,346*	*27,577*	*48,302*	*27*	*98,729*	*70,048*	*37,604*	*15*	*24,289*	*35,783*	*885*	*110*	*1,377*
December,	1915	91,124	59,231	36,467	..	214,967	81,939	33,527	..	..	3,052	6,016	1,940	5,555
,,	*1914*	*192,952*	*149,835*	*44,876*	..	*172,990*	*80,144*	*86,317*	..	..	*9,306*	*1,136*	*116*	*2,157*

STOCK IN QUARANTINE.

THE following stock was received into quarantine during the month of September, 1916:—

No.	Description.	Sex.	Port of Origin.	Owner or Agent.	Address.
		MOTUIHI ISLAND (AUCKLAND).			
1	Collie dog ..	Male ..	London ..	T. Cook and Sons	Auckland.
1	,, ..	Female	,, ..	,, ..	,,
1	Great Dane dog	,,	,, ..	C. Greville-Smith..	Cambridge.
		SOMES ISLAND (WELLINGTON).			
1	Collie dog ..	Male ..	London ..	J. R. Corrigan ..	Hawera.
1	,, bitch ..	Female	,, ..	,, ..	,,
5	,, pups ..	..	,, ..	,, ..	,,
1	Shorthorn bull..	Male ..	,, ..	R. D. D. McLean..	Hastings.
1	Hereford bull ..	,, ..	Liverpool ..	C. A. J. Levett ..	Kiwitea.
1	,, ..	,, ..	,, ..	E. Short ..	Feilding.
1	Shropshire ram	,, ..	,, ..	H. D. Vavasour ..	Blenheim.
		QUAIL ISLAND (LYTTELTON).			
1	Bealeyham terrier dog	Male ..	London ..	Miss Rich ..	Christchurch.
2	Ditto.. ..	Female	,, ..	,, ..	,,

FORTHCOMING AGRICULTURAL SHOWS.

Poverty Bay A. and P. Association: At Gisborne, 24th and 25th October.
Wairarapa and East Coast A. and P. Assn.: At Carterton, 25th and 26th October.
Timaru A. and P. Association: At Timaru, 25th and 26th October.
Manawatu and West Coast A. and P. Association: At Palmerston North, 1st, 2nd, and 3rd November.
Northern A. and P. Association: At Rangiora, 2nd November.
Canterbury A. and P. Association: At Christchurch, 9th and 10th November.
Marlborough A. and P. Association: At Blenheim, 14th and 15th November.
Whangarei A. and P. Society: At Whangarei, 14th and 15th November.
North Otago A. and P. Association: At Oamaru, 16th and 17th November.
Clevedon A. and P. Association: At Clevedon, 18th November.
Nelson A. and P. Association: At Richmond, 21st and 22nd November.
Wallace A. and P. Association: At Otautau, 22nd November.
Egmont A. and P. Association: At Hawera, 22nd and 23rd November.
Otago A. and P. Society: At Dunedin, 29th and 30th November.
Stratford A. and P. Association: At Stratford, 29th and 30th November.
Auckland A. and P. Association: At Auckland, 1st and 2nd December.
Southland A. and P. Association: At Invercargill, 12th and 13th December.
Tuapeka Agricultural Society: At Lawrence, 13th December.
Woodville A. and P. Association: At Woodville, 31st January.
Opotiki A. and P. Association: At Opotiki, 8th February.
Dannevirke A. and P. Association: At Dannevirke, 14th and 15th February.
Hukerenui Agricultural Association: At Towai, 15th and 17th February.
Northern Suburban A. and P. Assn.: At Takapuna, 16th and 17th February.
Northern Wairoa A. and P. Association: At Mititai, 17th February.
North Kaipara A. and P. Association: At Paparoa, 7th March.

(A. & P. Association secretaries are invited to supply particulars of their show dates.)

Shearing-time.